

# 2013 CALIFORNIA BUILDING CODE

## California Code of Regulations, Title 24, Part 2

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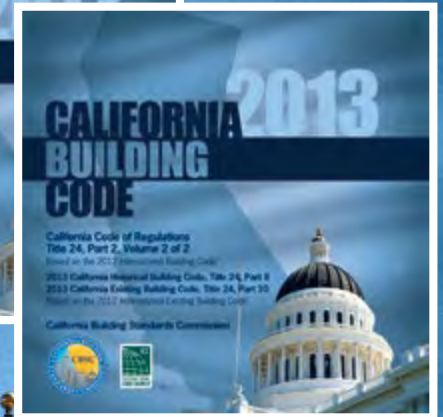
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# CALIFORNIA BUILDING CODE 2013

California Code of Regulations  
Title 24, Part 2, Volume 1 of 2  
Based on the 2012 International Building Code®

California Building Standards Commission







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# 2013

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Title 24, Part 2, Volume 1 of 2**

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## PREFACE

This document is Part 2 of 12 parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the state's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must be filed with the California Building Standards Commission to become effective and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

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This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

*Governor Edmund G. Brown Jr.*  
*Members of the California Building Standards Commission*  
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For questions on California state agency amendments, please refer to the contact list on the following page.

# CALIFORNIA CODE OF REGULATIONS, TITLE 24

## California Agency Information Contact List

### Board of State and Community Corrections

www.bscc.ca.gov ..... (916) 445-5073  
Local Adult Jail Standards  
Local Juvenile Facility Standards

### California Building Standards Commission

www.bsc.ca.gov ..... (916) 263-0916

### California Energy Commission

www.enregy.ca.gov ..... **Energy Hotline** (800) 772-3300  
Building Efficiency Standards  
Appliance Efficiency Standards  
Compliance Manual/Forms

### California State Lands Commission

www.slc.ca.gov ..... (562) 499-6312  
Marine Oil Terminals

### California State Library

www.library.ca.gov ..... (916) 654-0266

### Department of Consumer Affairs:

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www.acupuncture.ca.gov ..... (916) 515-5200  
Office Standards

#### Board of Pharmacy

www.pharmacy.ca.gov ..... (916) 574-7900  
Pharmacy Standards

#### Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov ..... (916) 952-5210  
Barber and Beauty Shop,  
and College Standards

#### Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation

www.bearhfti.ca.gov ..... (916) 999-2041  
Insulation Testing Standards

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www.pestboard.ca.gov ..... (800) 737-8188  
Structural Standards

#### Veterinary Medical Board

www.vmb.ca.gov ..... (916) 263-2610  
Veterinary Hospital Standards

### Department of Food and Agriculture

www.cdffa.ca.gov  
Meat & Poultry Packing Plant Standards (916) 654-0509  
Dairy Standards (916) 654-0773

### Department of Housing and Community Development

www.hcd.ca.gov ..... (916) 445-9471

Residential- Hotels, Motels, Apartments,  
Single-Family Dwellings; and  
Permanent Structures in Mobilehome &  
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &  
Commercial Modular

Mobilehome- Permits & Inspections  
Northern Region-(916) 255-2501  
Southern Region-(951) 782-4420

(916) 445-9471

Employee Housing Standards

### Department of Public Health

www.dph.ca.gov ..... (916) 449-5661

Organized Camps Standards  
Public Swimming Pools Standards

### Division of the State Architect

www.dgs.ca.gov/dsa. .... (916) 445-8100

#### Access Compliance

#### Structural Safety

Public Schools Standards  
Essential Services Building Standards  
Community College Standards

#### State Historical Building Safety Board

Alternative Building Standards

### Office of Statewide Health Planning and Development

www.oshpd.ca.gov ..... (916) 440-8356

Hospital Standards  
Skilled Nursing Facility Standards &  
Clinic Standards  
Permits

### Office of the State Fire Marshal

osfm.fire.ca.gov ..... (916) 445-8200

Code Development and Analysis  
Fire Safety Standards



## Marginal Markings

Solid vertical lines in the margins within the body of the code indicate a technical change from the requirements of the 2009 edition. Deletion indicators in the form of an arrow (➡) are provided in the margin where an entire section, paragraph, exception or table has been deleted or an item in a list of items or a table has been deleted.

A single asterisk [\*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk \*\*[\*\*] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2012 edition of the *International Building Code*.

2012 LOCATION	2009 LOCATION
407.4	1014.2
410.6	1015.6
424	402.6.3
712.1	708.1
712.1.2	708.2, Exception 1
712.1.3	708.2, Exception 2
712.1.3.1	708.2, Exception 2.1
712.1.3.2	708.2, Exception 2.2
712.1.4	708.2, Exception 3
712.1.5	708.2, Exception 4
712.1.6	708.2, Exception 5
712.1.7	708.2, Exception 6
712.1.8	708.2, Exception 7
712.1.9	708.2, Exception 8
712.1.10	708.2, Exception 9
712.1.11	708.2, Exception 10
712.1.12	708.2, Exception 11
712.1.13	708.2, Exception 12
712.1.14	708.2, Exception 13
712.1.15	708.2, Exception 14
712.1.16	708.2, Exception 15
712.1.18	708.2, Exception 16
713.3 through 713.14.1.1	708.3 through 708.14.1.1
909.21 through 909.21.11	708.14.2 through 708.14.2.11
1004.1.1.2	1004.6
1008.1.9.8	1008.1.4.4
1013.8	1405.13.2
1028.10.1	1017.4
1028.10.1.1	1017.4.1
1028.10.1.1	1017.4.2
1028.10.1.2	1017.4.3
1210.3.1	2903.1
1210.3.2	2903.2
1406.2.1	1406.2.1.1
1406.2.2	1406.2.1
1607.6	1605.4
1704.3	1705.1
<i>continued</i>	

<b>2012 LOCATION</b>	<b>2009 LOCATION</b>
1704.4	1709.1
1704.5	1710.1
1705.1.1	1704.15
1705.4.2	1704.11
1705.10	1706.1
1705.11	1707.1
1705.12	1708.1
3313.1	3311.4



# EFFECTIVE USE OF THE IBC/CBC

Distilling the code review process down to a methodical, sequential list of considerations is generally problematic. In many cases, related provisions from various chapters of the code must be considered simultaneously, or reconsidered later in the process to arrive at the correct classification or determination. Any number of acceptable alternatives may exist for construction of the building and its specific features. Each choice provided by the code must be evaluated for its specific impact on other aspects of the building's analysis. With a basic understanding of the interrelationship of the various chapters, the practiced code user will make an initial assessment of the building as a first step of the code review process. The following outline may be helpful as a guide for the effective use of the IBC, with the understanding that final resolution of each step is often dependant on subsequent steps.

The following process begins with a brief discussion of the key administrative areas of the code. The process addressing technical provisions is divided into two distinct areas of analysis, the nonstructural provisions of the IBC and the structural provisions. Although reference is not made to all provisions set forth in the IBC, the process is intended to be representative of an approach to using the IBC in an effective manner.

## Administrative Provisions

Prior to any analysis based on the technical provisions of the IBC, it is important that the fundamental administrative aspects of the code be reviewed. It is critical that the basis of technical decisions be consistent with the approach established in IBC Chapter 1, including:

- Scope of the IBC
- Intent of the IBC
- Applicability of the IBC
- Duties and powers of the building official
- Alternate materials, designs and methods of construction

## Nonstructural Provisions

**1. Classify the building for occupancy and construction type.** The first step in analyzing a building for code compliance is its proper classification based on anticipated use(s) and construction features.

**Identify the distinct and varied uses of the building.** The uses that will occur within the building must be identified, evaluated and classified into one or more of the distinct occupancy classifications established in the IBC. Some buildings will be classified as single-occupancy, where there is only one applicable occupancy classification. Others will be considered as mixed-occupancy due to the presence of two or more uses that are classified into different occupancy groups.

**Sec. 302.1 Classify the building into one or more occupancy groups.** Although there are 10 general occupancy groups, many of the groups are subdivided into sub-groups to allow for a more exacting analysis of the building under consideration.

Sec. 303	Group A
Sec. 304	Group B
Sec. 305	Group E
Sec. 306	Group F
Sec. 307	Group H
Sec. 308	Group I
Sec. 309	Group M
Sec. 310	Group R
Sec. 311	Group S
Sec. 312	Group U

**Identify the building's type of construction based on the materials of construction and degree of fire-resistance for the building's major elements.** The primary structural frame, exterior walls, interior walls, floor construction and roof construction, as applicable, must be evaluated in regard to their degree of fire-resistance and materials of construction in order to classify the building based upon type of construction.

**Sec. 602.1 Classify the building into a single type of construction.** Five general types of construction have been established and further subdivided into nine specific construction types. The classification of construction type is based on a combination of the degree of fire-resistance and the type of materials of the key building elements.

Sec. 602	Type of construction based on materials of construction
Table 601	Type of construction based on fire rating of the building elements
Sec. 603	Combustible materials in Type I and II buildings

**Sec. 1505 Verify classification of roof covering.** Roof coverings are typically required to provide protection against moderate or light fire exposures from the exterior. Their minimum required classification is based upon the type of construction of the building.

**2. Determine if the building is to be fully sprinklered.** Many of the code provisions vary based upon the presence of an automatic sprinkler system throughout, or in specific portions of, the building.

**Sec. 903.2 Determine if the building requires a fire sprinkler system.** Many of the mandates for the installation of a sprinkler system are based upon the occupancy or occupancies that occur within the building. The provisions will often require some degree of occupant load and fire area determination. Other conditions may also trigger a required sprinkler installation, such as building height or the lack of exterior openings.

**If a sprinkler system is not required, review for potential code modifications if a sprinkler system is installed.** There are a significant number of benefits provided by the code if a sprinkler system is installed. An initial analysis of the building will typically allow for an early determination of the value of such sprinkler benefits, including:

Sec. 504.2	Story and height increase (reduced type of construction)
Sec. 506.3	Allowable area increase (reduced type of construction)
Sec. 507.3	Unlimited area building (reduced type of construction)
Sec. 1018.1	Elimination of corridor fire-resistance rating

**3. Locate the building on the site.** The location of the building(s) on the lot is fundamental to the degree of fire exposure to and from adjoining buildings and lots. In addition, the building's location influences the amount of fire department access that can be provided from the exterior of the building.

**Sec. 503.1.2 Determine the number of buildings on the site.** Where two or more buildings are located on the same lot, they can be evaluated as a single building or multiple buildings. The type of construction requirements may differ based upon which of the two methods is utilized.

**Sec. 602.1 Determine minimum required fire rating of exterior walls.** The fire separation distance is the measurement used in evaluating the necessary fire rating for exterior walls. It is measured from the building to the lot line, to the center line of a public way, or to an imaginary assumed line between two buildings on the same lot. Projections and parapets, if applicable, are also regulated.

**Sec. 704.8 Determine exterior opening protection requirements.** Openings in exterior walls are regulated by the fire separation distance and the rating of the exterior wall in which they are located.

**Sec. 506.2 Determine frontage increase for allowable area purposes.** Utilized primarily for fire department access, open space adjacent to a building's perimeter provides for an increase in the allowable area.

**4. Verify building's construction type by determining the allowable building size.** The permitted types of construction are primarily based upon the occupancy classifications involved, the building's height and the building's floor area. Other conditions may also affect the appropriate construction types, including the building's location on the lot and the intended materials of construction. In buildings with mixed-occupancy conditions, the methods of addressing the relationship between the multiple occupancies indirectly affect construction type.

**Sec. 202 and 502 Calculate actual height of building in both 'feet' and 'stories above grade plane'.** The code specifically describes the method for assigning a building height, measure both in the number of feet and the number of stories above grade plane. The actual height must be compared with the allowable height to determine if the building's type of construction is acceptable.

**Sec. 504 Determine allowable height permitted for 'feet' and 'stories'**

**Sec. 505 Determine if mezzanine provisions are applicable**

**Sec. 504.3 Determine if any rooftop structures are in compliance**

**Sec. 502 Calculate actual floor area of each story of building.** The building area is typically the entire floor area that occurs within the surrounding exterior walls. The building area for each individual story must be calculated, as well as for the building as a whole.

**Sec. 507 Determine if building qualifies as an unlimited area building****Sec. 506 Determine allowable area permitted for each story and building as a whole if:**

- Sec. 506 Single-occupancy building
- Sec. 508.2 Multi-occupancy w/accessory occupancies
- Sec. 508.3 Multi-occupancy building w/nonseparated occupancies
- Sec. 508.4 Multi-occupancy building w/separated occupancies
- Sec. 706.1 Use of fire walls

**Sec. 509 Determine if special provisions are to be applied for height and/or area.** The general requirements for allowable height and area may be modified under limited conditions, typically where a parking garage is located in a building with other occupancies.

**5. Identify extent of any special detailed occupancy requirements.** Special types of buildings, special uses that occur within buildings, and special elements of a building are further regulated through specific requirements found in Chapter 4. Since these provisions are specific in nature, they apply in lieu of the general requirements found elsewhere in the code.

**Chapter 4. Determine special detailed requirements based on occupancy.** A number of the special provisions are applicable to a specific occupancy or group of similar occupancies.

- Sec. 402 Covered mall buildings
- Sec. 403 High-rise buildings
- Sec. 404 Atriums
- Sec. 405 Underground buildings
- Sec. 406 Motor-vehicle-related occupancies
- Sec. 407 Group I-2 occupancies
- Sec. 408 Group I-3 occupancies
- Sec. 411 Special amusement buildings
- Sec. 412 Aircraft-related occupancies
- Sec. 415 Group H occupancies
- Sec. 419 Live/work units
- Sec. 420 Groups I-1, R-1, R-2 and R-3
- Sec. 422 Ambulatory health care facilities

**Table 508.2.5 Determine if building contains any incidental accessory occupancies.** The uses identified in Table 508.5.2 are considered as a portion of the occupancy in which they are located, but special conditions required that they be addressed in a more specific manner.

- Sec. 508.2.5 Provide fire separation and/or fire-extinguishing system

**6. Identify and evaluate fire and smoke protective elements.** Where fire-resistance-rated construction and/or smoke protection is mandated by other provisions of the code, the provisions of Chapter 7 identify the appropriate methods for gaining compliance.

**Chapter 7. Verify compliance w/details of fire and smoke resistance.** The various elements of fire-resistance-rated and smoke-resistant construction are detailed, including walls, horizontal assemblies, shaft enclosures, including openings such as doors and windows, as well as the penetration of such elements by conduit, ducts, piping and other items.

- Sec. 704 Structural members
- Sec. 707 Fire barriers
- Sec. 709 Fire partitions
- Sec. 710 Smoke barriers
- Sec. 711 Smoke partitions
- Sec. 712 Horizontal assemblies
- Sec. 708 Shaft enclosures
- Sec. 713 Penetrations
- Sec. 714 Joint systems
- Sec. 715 Opening protectives
- Sec. 716 Ducts and air transfer openings

**7. Identify additional fire protection systems that may be required.** In addition to automatic sprinkler systems, there are several other types of fire protection systems that may be required in a building.

**Sec. 907.2. Determine compliance with fire alarm provisions.** Fire alarm systems are typically mandated based upon the occupancy classification and the number of occupants.

**Sec. 905.3. Determine if standpipe system is required.** A standpipe system is required in buildings once a specified height is reached to provide for a more effective means of fighting a fire within the building.

**Sec. 905.4.6. Verify location of standpipe hose connections.**

**8. Identify and evaluate materials utilized as interior floor, wall and ceiling finishes.** Finish materials within the building are primarily regulated for flame spread and smoke development characteristics.

**Sec. 803.9. Verify compliance of wall and ceiling finishes.** Interior wall and ceiling finishes are regulated based upon the occupancy classification of the space and their location within the means of egress system. The classification may typically be reduced where sprinkler protection is provided.

**Sec. 804.4. Verify compliance of floor finishes.** While regulated differently than wall and ceiling finishes, floor finishes comprised of fibers are also controlled based upon their use in the egress system, the occupancy classification, and the presence of a sprinkler system.

**9. Evaluate means of egress system based on anticipated occupant loads.** The expected occupant load is the basis for the design of the means of egress system. The egress elements must provide for a direct, continuous, obvious, undiminished and unobstructed path of travel from any occupiable point in the building to the public way.

**Sec. 1004. Determine the design occupant load.** Although the primary use of an occupant load is in the design of the building's means of egress system, occupant load is also occasionally an important factor in occupancy classification, sprinkler system and fire alarm system requirements, and plumbing fixture counts.

**Chapter 10. Verify compliance with means of egress provisions.** The means of egress system is intended to provide the primary occupant protection from fire and other hazards. The system consists of two major components, egress components and egress design.

- Sec. 1005.1 Egress width and distribution
- Sec. 1006.3 Emergency lighting
- Sec. 1007 Accessible means of egress
- Sec. 1008.1.2 Door swing
- Sec. 1008.1.9 Door operations
- Sec. 1008.1.10 Panic hardware
- Sec. 1009.1 Stairway width
- Sec. 1009.4 Stairway treads and risers
- Sec. 1011 Exit signs
- Sec. 1012 Stairway and ramp handrails
- Sec. 1013 Guards
- Sec. 1014.2 Egress through intervening spaces
- Sec. 1014.3 Common path of egress travel
- Sec. 1015.1 Number of exit or exit access doorways
- Sec. 1015.2 Egress separation
- Sec. 1016.1 Travel distance
- Sec. 1018.1 Corridor construction
- Sec. 1021 Number of exits
- Sec. 1022 Vertical exit enclosures
- Sec. 1023 Exit passageways
- Sec. 1025 Horizontal exits
- Sec. 1026 Exterior exit stairways
- Sec. 1027 Exit discharge
- Sec. 1028 Egress from assembly occupancies

**10. Identify any special use features of the building.** The activities that occur within the building pose varying risks to the occupants. Special conditions are applicable when such activities are anticipated.

**Chapter 4. Verify compliance with special detailed requirements.** These provisions are often an extension of the general requirements found elsewhere in the code.

Sec. 410	Stages and platforms
Sec. 413	Combustible storage
Sec. 414	Hazardous materials
Sec. 416	Application of flammable finishes

**11. Determine areas of building and site required to be accessible.** In general, access to persons with disabilities is required for all buildings.

**Chapter 11A and/or 11B. Verify compliance with accessibility provisions.** In order to be considered as accessible, buildings and their individual elements must comply with the applicable technical provisions of Chapters 11A and/or 11B.

**12. Determine extent of other miscellaneous provisions.** Additional provisions may be applicable based upon each individual building and its characteristics.

**Sec. 2406.3. Verify safety glazing provided in hazardous locations.** Safety glazing must be appropriately identified to ensure the proper glazing material is installed in areas considered as subject to human impact.

**Chapter 12. Interior environment.** Provisions regulating ventilation, temperature control, lighting, sound transmission, room dimensions and surrounding materials associated with interior spaces.

**Chapter 14 Exterior walls.** Requirements for installation of wall coverings and the permissible use of combustible materials on the exterior side of exterior walls.

**Chapter 24. Glass and glazing.** General provisions for the installation of glazing materials and skylights.

**Chapter 30. Elevators.** Elevator hoistway provisions, including enclosure of hoistways, emergency operations and hoistway venting.

**Chapter 31. Special construction.** A variety of special conditions are addressed, including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings and canopies, marquees, signs and swimming pool enclosures.

## Structural Provisions

### General Requirements

#### 1. Design Loads.

The 2012 IBC references the national load standard, Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7—10) with Supplement Number 2.

Determine the applicable design loads that the building structure is expected to be subjected to. Code prescribed loads are given in Chapter 16 and the referenced standard, ASCE/SEI 7. The code prescribed minimum live loads are given in IBC Table 1607.1.

The various code prescribed loads are probabilistic in nature. Environmental loads, such as flood, rain, snow, seismic and wind vary based on the location of the building site. The following table gives the IBC section and ASCE/SEI 7 chapter for various types of load.

REFERENCED IBC SECTIONS AND ASCE/SEI 7 CHAPTERS FOR LOADS		
TYPE OF LOAD	IBC SECTION	ASCE/SEI 7 CHAPTER
Dead loads	Section 1606	Chapter 3
Live loads	Section 1607, Table 1607.1	Chapter 4
Snow loads	Section 1608	Chapter 7
Wind loads	Section 1609	Chapter 6
Soil lateral loads	Section 1610	Chapter 3
Rain loads	Section 1611	Chapter 8
Flood loads	Section 1612	Chapter 51
Earthquake loads	Section 1613	Chapter 11-22

1. Section 1612 references ASCE 24 which references Chapter 5 of ASCE/SEI 7



## 2. Structural Materials.

The structural design begins with the selection of the type of structural materials to be used to support the building. Structural framing systems are constructed of concrete, masonry, steel or wood. Some miscellaneous or specialty structures and components, such as awnings, canopies and cladding, are often constructed of aluminum.

The design of various structural materials is covered in specific material chapters in the code which in turn reference design standards for the type of material involved. The referenced standards in the 2012 IBC for the structural materials are shown in the following table:

STRUCTURAL DESIGN STANDARDS FOR STRUCTURAL MATERIALS <sup>1</sup>		
MATERIAL	IBC/CBC CHAPTER	REFERENCED STANDARD
Concrete	19	ACI 318—11 Building Code Requirements for Structural Concrete
Aluminum	20	ADM 1—10 Aluminum Design Manual
Masonry	21	TMS 402-11/ACI 530-11/ASCE 5-11 Building Code Requirements and Specification for Masonry Structures (MSJC Code)
Steel	22	AISC 360—10 Specification for Structural Steel Buildings  AISC 341—10 Seismic Provisions for Structural Steel Buildings  AISI S100—07/S2-10 North American Specification for the Design of Cold-Formed Steel Structural Members, with Supplement 1, dated 2010.
Wood	23	AF&PA NDS—12 National Design Specification (NDS) for Wood Construction with 2012 Supplement  AF&PA SDPWS—08 Special Design Provisions for Wind and Seismic

1. The above table shows the main structural design standards for these structural materials. For a complete list of referenced standards, see IBC Chapter 35.

## 3. Structural Analysis, Design and Detailing.

Once the applicable loads are determined, the structural system of the building must be analyzed to determine the effects of the governing gravity and lateral loads that act on the structure. The structural system of a typical building consists of the roof and floor systems, walls, beams and columns, and the foundation. From the structural analysis, the next step is to design the structural members, elements and systems to provide the minimum level of resistance in accordance with the various load combinations prescribed in Section 1605.

Once the structural elements and systems are designed, the next step is to detail the load transfer connections to provide a complete load path from the point of origin to the resisting element. In general, the ultimate resisting element of buildings and structures is the foundation and supporting ground. The final step is to prepare a complete set of construction documents as required by Sections 107 and 1603. Construction documents are defined in Section 202 as “Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.” In general, construction documents consist of plans, specifications and calculations.

Section 1603.1 requires construction documents to show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. Design loads required by Sections 1603.1.1 through 1603.1.9 must be indicated on the construction documents. If complete construction documents consisting of plans, specifications and calculations are provided, the items listed in Sections 1603.1.1 through 1603.9 are generally included.

The exception permits construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 need only indicate the following:

- Floor and roof live loads
- Ground snow load,  $P_g$ .
- Basic (3-second gust) wind speed (mph) and wind exposure category.
- Seismic design category and site class.
- Flood design data where sited in flood hazard areas
- Design load-bearing values of soils.

## General Requirements

### 1. Occupancy Category (IBC/CBC Table 1604.5).

Determine the occupancy category of the building based on Table 1604.5.

Where a structure is occupied by two or more occupancies that are not the same occupancy category, the building must be classified in the highest occupancy category corresponding to the various occupancies.

Where structures have two or more portions that are structurally separated, each separate portion should be separately classified.

Where a separated portion of a structure provides required access or egress from another portion of the building with a higher occupancy category, both portions of the building must be assigned the higher occupancy category.

Where a separated portion of a structure shares life safety components with another portion of the building with a higher occupancy category, both portions of the building must be assigned the higher occupancy category.

### 2. Floor and roof live loads (IBC/CBC Table 1607.1).

Determine uniformly distributed and concentrated floor live load for the floor areas of the building in accordance with Section 1603.1.1 and Table 1607.1.

Floor live load reduction in accordance with Section 1607.9 should be indicated for each type of live load that is reduced.

Determine the roof live load for roof areas in accordance with Section 1607.11.

Roof live load reduction in accordance with Section 1607.11.2 should be indicated for roof live loads that are reduced.

### 3. Snow load (IBC/CBC Section 1608, ASCE/SEI 7 Section 7).

Determine the ground snow load,  $P_g$ , based on the location of the building site in accordance with Figure 1608.2 for the contiguous United States and Table 1608.2 for Alaska.

In areas where the ground snow load,  $P_g$ , exceeds 10 psf, the following information should be determined:

1. Flat-roof snow load,  $P_f$ .
2. Snow exposure factor,  $C_e$ .
3. Snow load importance factor,  $I$ .
4. Thermal factor,  $C_t$ .

### 4. Wind speed and wind exposure category.

Determine the following information related to wind loads in accordance with Section 1603.1.4:

1. Basic 3-second gust wind speed (mph).
2. Wind importance factor,  $I$ .
3. Wind exposure category (B, C, D). If more than one wind exposure is used, the wind exposure for each wind direction should be determined.
4. The applicable internal pressure coefficient.
5. The design wind pressure (psf) used for the design of exterior component and cladding materials not specifically designed by the registered design professional should be indicated.

## 5. Earthquake design requirements.

Determine the following information related to seismic loads regardless of whether seismic loads govern the design of the lateral-force-resisting system of the building:

1. Seismic importance factor,  $I$ , based on occupancy category.
2. Mapped spectral response accelerations,  $S_S$  and  $S_L$ .
3. Site class.
4. Design spectral response coefficients,  $S_{DS}$  and  $S_{D1}$ .
5. Seismic design category.
6. Basic seismic-force-resisting system(s).
7. Design base shear.
8. Seismic response coefficient(s),  $C_s$ .
9. Response modification factor(s),  $R$ .
10. Analysis procedure used.

## 6. Geotechnical information.

The design load bearing values of soils shall be shown on the construction documents in accordance with Section 1603.1.6.

## 7. Special loads.

Determine any special loads that are applicable to the design of the building, structure or portions thereof along with the specific section of the code that addresses the special loading condition in accordance with Section 1603.1.8.

## 8. Load combinations.

Buildings and other structures and portions thereof are required to be designed to resist the load combinations specified in Section 1605.2 or 1605.3 and Chapters 18 through 23, and the special seismic load combinations with overstrength as required by Section 1605.1 and ASCE/SEI 7.

## 9. Wind and seismic detailing.

Lateral-force-resisting systems are required to conform to the seismic detailing requirements of the code and ASCE/SEI 7 (excluding Chapter 14 and Appendix 11A) even when wind load effects are greater than seismic load effects. See Section 1604.10.

## 10. Serviceability.

Structural systems and members shall be designed to have adequate stiffness to limit deflections and lateral drift. The deflection of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.6 or that permitted by Table 1604.3. Structural systems shall be designed to have adequate stiffness to limit deformation and lateral drift due to earthquake loading in accordance with Section 12.12.1 of ASCE/SEI 7.

## 11. Foundation.

A foundation system must be designed that provides adequate support for gravity and lateral loads. Walls of buildings of conventional light frame construction, as defined in Section 202, are permitted to be supported by footings constructed in accordance with Table 1809.7. Otherwise, the foundation system must be designed in accordance with other provisions of Chapter 18. The following table gives a summary of applicable sections for foundation systems.

FOUNDATION REQUIREMENTS	
SUBJECT	IBC SECTION
Presumptive load-bearing values of soils	1806, Table 1806.2
Foundation walls, retaining walls and embedded posts & poles	1807
General requirements for foundations	1808
Minimum concrete specified concrete strength	Table 1808.8.1
Minimum concrete cover	Table 1808.8.2
Shallow foundations (footings)	1809
Prescriptive footings for light frame walls	Table 1809.7
Deep foundations	1810

A geotechnical investigation is required where required by Section 1803.2 unless the building official determines that a soils investigation is not required in accordance with the exception. A geotechnical investigation is required for buildings assigned to Seismic Design Categories C, D, E and F in accordance with Sections 1803.5.11 and 1803.5.12.

## 12. Excavation, grading and fill

Requirements for excavation, grading and fill related to foundation construction are covered in Section 1804. General requirements for site grading are covered in Appendix J.

## 13. Flood design data.

Where required by Section 1612.5, buildings located in flood hazard areas as established in Section 1612.3 are required to provide documentation that includes the following information regardless of whether flood loads govern the design of the building:

1. In flood hazard areas not subject to high-velocity wave action, the elevation of the proposed lowest floor, including the basement; and the elevation to which any nonresidential building will be dry flood proofed.
2. In flood hazard areas not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry floodproofed.
3. In flood hazard areas subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

## 14. Special inspection.

Where special inspection, special inspection for seismic resistance, or structural testing for seismic resistance is required by Section 1704, 1707 or 1708, the registered design professional in responsible charge is required to prepare a statement of special inspections in accordance with Section 1705. The statement of special inspections must be submitted by the permit applicant as a condition of permit issuance in accordance with Section 106.1.

A statement of special inspections is not required for structures designed and constructed in accordance with the conventional construction provisions of Section 2308 unless specific components in the structure require special inspection.

The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

SPECIAL INSPECTION REQUIREMENTS		
TYPE OF SPECIAL INSPECTION	APPLICABLE SECTION	REQUIRED VERIFICATION AND INSPECTION
Steel construction	1704.3	Table 1704.3
Concrete construction	1704.4	Table 1704.4
Masonry construction		
Level 1	1704.5	Table 1704.5.1
Level 2		Table 1704.5.3
Wood construction	1704.6	—
Soils	1704.7	Table 1704.7
Driven deep foundations	1704.8	Table 1704.8
Cast in place deep foundations	1704.9	Table 1704.9
Helical pile foundations	1704.10	—
Vertical masonry foundations	1704.11 1704.5	—
Sprayed fire resistant materials	1704.12	—
Mastic and intumescent fire resistive coatings	1704.13	—
Exterior insulation and finish (EIFS) systems	1704.14	—
Special cases	1704.15	—
Smoke control systems	1704.16	—

Where required by the provisions of Section 1709.2 or 1709.3, the owner shall employ a registered design professional to perform structural observations as defined in Section 1702. At the conclusion of the work included in the permit, the structural observer shall submit a written statement to the building official that identifies any reported deficiencies that have not been resolved.

**15. Special inspection for wind and seismic resistance.**

Section 1706.1 requires special inspections for wind requirements based on wind speed and exposure category as prescribed in Sections 1706.2 through 1706.4, unless exempted by the exceptions to Section 1704.1.

Section 1707.1 requires special inspections for seismic resistance based on seismic design category as prescribed in Sections 1707.2 through 1707.9, unless exempted by the exceptions of Section 1704.1 or 1705.3.

**16. Structural testing for seismic resistance.**

Section 1708.1 requires specific testing and qualification for seismic resistance as prescribed in Sections 1708.2 through 1708.5, unless exempted from special inspections by the exceptions of Section 1704.1 and 1705.3.

**17. Structural observation.**

Where required by the provisions of Section 1710.2 or 1710.3 the owner is required to employ a registered design professional to perform structural observations as defined in Section 1702. Section 1710.2 requires structural observations for seismic resistance for certain structures assigned to Seismic Design Category D, E or F; Section 1710.3 requires structural observations for wind requirements for certain structures sited where the wind speed exceeds 110 mph.

At the conclusion of the work included in the permit, the structural observer is required to submit a written statement to the building official that identifies any reported deficiencies that have not been resolved.

Prior to the commencement of observations, the structural observer is required to submit a written statement to the building official identifying the structural observations.

At the conclusion of the work included in the permit, the structural observer is required to submit a written statement to the building official indicating what site visits have been made, identifies any deficiencies that have not been resolved.

**18. Contractor responsibility.**

Section 1709 requires each contractor responsible for the construction of a main wind- or seismic-force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections is required to submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. (The term “designated seismic system” is defined in Section 1702 and Section 11.2 of ASCE/SEI 7). The contractor’s statement of responsibility is required to acknowledge awareness of the special requirements contained in the statement of special inspections.

**19. Phased approvals.**

Construction of foundations or other part of a building is permitted before the construction documents for the whole building or structure have been submitted, provided adequate information has been filed. The holder of such permit for the foundation or other part of a building proceeds at their own risk and without assurance that a permit for the entire structure will be granted.

**20. Amended construction documents.**

Work must be constructed in accordance with the approved construction documents and any changes made during construction that are not in compliance with the approved construction documents must be resubmitted for approval as amended construction documents.

**21. Deferred submittals.**

Deferred submittals are items that are not submitted at the time of permit application and must have the prior approval of the building official in accordance with Section 107.3.4.2. The registered design professional in responsible charge is required to list the deferred submittals on the construction documents for review by the building official. Documents for deferred submittal items must be reviewed by the registered design professional in responsible charge who will forward them to the building official with a notation indicating that they have been reviewed and are in general conformance with the design of the building.



# **How to Distinguish Between Model Code Language and California Amendments**

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italic font print.

**[BSC]** This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption, and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.

## **Legend of Acronyms of Adopting State Agencies**

<i>BSC</i>	<i>California Building Standards Commission (see Section 1.2)</i>
<i>BSCC</i>	<i>Board of State and Community Corrections (see Section 1.3)</i>
<i>SFM</i>	<i>Office of the State Fire Marshal (see Section 1.11)</i>
<i>HCD 1</i>	<i>Department of Housing and Community Development (see Section 1.8.2.1.1)</i>
<i>HCD 2</i>	<i>Department of Housing and Community Development (see Section 1.8.2.1.3)</i>
<i>HCD 1/AC</i>	<i>Department of Housing and Community Development (see Section 1.8.2.1.2)</i>
<i>DSA-AC</i>	<i>Division of the State Architect-Access Compliance (see Section 1.9.1)</i>
<i>DSA-SS</i>	<i>Division of the State Architect-Structural Safety (see Section 1.9.2)</i>
<i>DSA-SS/CC</i>	<i>Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)</i>
<i>OSHPD 1</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.1)</i>
<i>OSHPD 2</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.2)</i>
<i>OSHPD 3</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.3)</i>
<i>OSHPD 4</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.4)</i>
<i>DPH</i>	<i>Department of Public Health (see Section 1.7)</i>
<i>AGR</i>	<i>Department of Food and Agriculture (see Section 1.6)</i>
<i>CEC</i>	<i>California Energy Commission (see Section 100 in Part 2, the California Energy Code)</i>
<i>CA</i>	<i>Department of Consumer Affairs (see Section 1.6): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Home Furnishings Structural Pest Control Board</i>
<i>SL</i>	<i>State Library (see Section 1.12)</i>
<i>SLC</i>	<i>State Lands Commission (see Section 1.14)</i>
<i>DWR</i>	<i>Department of Water Resources (see Section 1.12 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)</i>

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages xvii and xviii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission [www.bsc.ca.gov](http://www.bsc.ca.gov).

Symbols in the margins indicate the status of code changes as follows:

|| This symbol indicates that a change has been made to a California amendment.

> This symbol indicates deletion of California amendment language.

| This symbol indicates that a change has been made to International Code Council model language.

➡ This symbol indicates deletion of International Code Council model language.

# California Matrix Adoption Tables

## Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency's statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies' adoption as follows:

## Adopt the entire IBC chapter without state amendments.

If there is an "X" under a particular state agency's acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

### Example:

**CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE**  
(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building application.)

#### CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter		X																	
Adopt entire chapter as amended (amended sections listed below)						S	A	M	P	L	E								
Adopt only those sections that are listed below																			
Chapter/Section																			

## Adopt the entire IBC chapter as amended, state-amended sections are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an "X" in the column, by that particular section, under the agency's acronym, as well as an "X" by each section that the agency has adopted.

### Example:

#### CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter																			
Adopt entire chapter as amended (amended sections listed below)		X																	
Adopt only those sections that are listed below						S	A	M	P	L	E								
Chapter/Section																			
202		X																	

## Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

### Example:

#### CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter																			
Adopt entire chapter as amended (amended sections listed below)																			
Adopt only those sections that are listed below				X	X		S	A	M	P	L	E							
Chapter 1																			
202				X	X		S	A	M	P	L	E							
202				X	X			C	O	N	T.								
203				X	X														
203				X	X														

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# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 1 – ADMINISTRATION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Chapter / Section																				
Division I – <i>California Administration</i>																				
1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
1.2	X	X																		
1.3		X											X							
1.4		X																X		
1.5 (Reserved)		X																		
1.6		X													X					
1.7		X												X						
1.8		X	X	X	X															
1.9		X																		
1.9.1 – 1.9.1.8						X														
1.9.2.1							X													
1.9.2.1.1							X													
1.9.2.1.2							X													
1.9.2.1.3							X													
1.9.2.2								X												
1.9.2.2.1								X												
1.9.2.2.2								X												
1.9.2.2.3								X												
1.9.2.2.4								X												
1.9.3								X												
1.10		X																		
1.10.1									X											
1.10.2										X										
1.10.3											X									
1.10.4												X								
1.11		X																		
1.12		X																	X	
1.13 (Reserved)																				
1.14																				X
Division II – <i>Scope and Administration</i>																				
101.1 – 101.4.5						X			X	X	X	X								
101.4.6, <i>Exception</i>									X	X		X								
102.1							X	X	X	X	X	X								
102.2 – 102.4							X	X	X	X	X	X								
102.4.1							X	X												
102.4.3							X	X	X	X	X	X								
102.4.4							X	X	X	X	X	X								
102.5							X	X	X	X	X	X								
102.6 – 104.1									X	X	X	X								
104.2 – 104.4		X							X	X	X	X								
104.5 – 104.8									X	X	X	X								

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 1 – ADMINISTRATION—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Chapter / Section																				
Division II – <i>Scope and Administration-cont'd</i>																				
104.9		X					X	X	X	X	X	X								
104.10							X	X	X	X	X	X								
104.11							X	X	X	X		X								
104.11.1 – 104.11.2									X	X	X	X								
104.11.3 – 104.11.4									X			X								
105.1		X							X	X	X	X								
105.1.1 – 105.2									X	X	X	X								
105.2 Building: 1-13			X	X																
105.2.1 – 105.2.2		X							X	X	X	X								
105.2.3									X	X	X	X								
105.3 – 105.3.1		X							X	X	X	X								
105.3.2									X	X		X								
105.4		X							X	X	X	X								
105.5									X	X	X	X								
105.6 – 105.7		X							X	X	X	X								
106.1		X					X	X	X	X	X	X								
106.1.1							X	X	X	X		X								
106.1.2									X	X		X								
106.2 – 106.3		X							X	X	X	X								
107.1		X	X	X					X	X	X	X								
107.2.1			X	X																
107.2.4			X	X																
107.2.5			X	X																
107.2 - 107.3		X							X	X	X	X								
107.3.4.2									X	X		X								
107.4		X							X	X		X								
107.5		X							X	X	X	X								
108.1 – 108.4		X							X	X	X	X								
109									X	X	X	X								
110.1 – 110.3		X							X	X	X	X								
110.3.1 – 110.3.3			X	X					X	X	X	X								
110.3.4 – 110.3.6		X	X	X					X	X	X	X								
110.3.8 – 110.3.10		X	X	X					X	X	X	X								
110.4 – 110.6		X							X	X	X	X								
111.1		X							X	X	X	X								
111.2		X				X			X	X	X	X								
111.3 – 111.4		X							X	X	X	X								
112		X							X	X	X	X								
113									X	X	X	X								
114.1 – 114.2		X							X	X	X	X								
114.2 – 114.3									X	X	X	X								
115 - 116		X							X	X	X	X								

# CHAPTER 1

## SCOPE AND ADMINISTRATION

### DIVISION I

## CALIFORNIA ADMINISTRATION

#### SECTION 1.1

##### GENERAL

**1.1.1 Title.** *These regulations shall be known as the California Building Code, may be cited as such and will be referred to herein as “this code.” The California Building Code is Part 2 of twelve parts of the official compilation and publication of the adoption, amendment and repeal of building regulations to the California Code of Regulations, Title 24, also referred to as the California Building Standards Code. This part incorporates by adoption the 2012 International Building Code of the International Code Council with necessary California amendments.*

**1.1.2 Purpose.** *The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation and energy conservation; safety to life and property from fire and other hazards attributed to the built environment; and to provide safety to fire fighters and emergency responders during emergency operations.*

**1.1.3 Scope.** *The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout the State of California.*

**1.1.3.1 Nonstate-regulated buildings, structures and applications.** *Except as modified by local ordinance pursuant to Section 1.1.8, the following standards in the California Code of Regulations, Title 24, Parts 2, 2.5, 3, 4, 5, 6, 9, 10 and 11 shall apply to all occupancies and applications not regulated by a state agency.*

**1.1.3.2 State-regulated buildings, structures and applications.** *The model code, state amendments to the model code, and/or state amendments where there are no relevant model code provisions shall apply to the following buildings, structures, and applications regulated by state agencies as specified in Sections 1.2 through 1.14, except where modified by local ordinance pursuant to Section 1.1.8. When adopted by a state agency, the provisions of this code shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.*

**Note:** *See Preface to distinguish the model code provisions from the California provisions.*

1. *State-owned buildings, including buildings constructed by the Trustees of the California State University, and to the extent permitted by Califor-*

*nia laws, buildings designed and constructed by the Regents of the University of California, and regulated by the Building Standards Commission. See Section 1.2 for additional scope provisions.*

2. *Local detention facilities regulated by the Corrections Standards Authority. See Section 1.3 for additional scope provisions.*
3. *Barbering, cosmetology or electrolysis establishments, acupuncture offices, pharmacies, veterinary facilities and structural pest control locations regulated by the Department of Consumer Affairs. See Section 1.4 for additional scope provisions.*
4. *Energy efficiency standards regulated by the California Energy Commission. See Section 1.5 for additional scope provisions.*
5. *Dairies and places of meat inspection regulated by the Department of Food and Agriculture. See Section 1.6 for additional scope provisions.*
6. *Organized camps, laboratory animal quarters, public swimming pools, radiation protection, commissaries serving mobile food preparation vehicles and wild animal quarantine facilities regulated by the Department of Public Health. See Section 1.7 for additional scope provisions.*
7. *Hotels, motels, lodging houses, apartment houses, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities. See Section 1.8.2.1.1 for additional scope provisions.*
8. *Accommodations for persons with disabilities in buildings containing newly constructed covered multifamily dwellings, new common use spaces serving existing covered multifamily dwellings, additions to existing buildings where the addition alone meets the definition of “COVERED MULTIFAMILY DWELLING,” and common-use spaces serving covered multifamily dwellings, which are regulated by the Department of Housing and Community Development. See Section 1.8.2.1.2 for additional scope provisions.*
9. *Permanent buildings and permanent accessory buildings or structures constructed within mobile-home parks and special occupancy parks regulated by the Department of Housing and Community Development. See Section 1.8.2.1.3 for additional scope provisions.*

10. Accommodations for persons with disabilities regulated by the Division of the State Architect. See Section 1.9.1 for additional scope provisions.
11. Public elementary and secondary schools, community college buildings and state-owned or state-leased essential service buildings regulated by the Division of the State Architect. See Section 1.9.2 for additional scope provisions.
12. Qualified historical buildings and structures and their associated sites regulated by the State Historical Building Safety Board with the Division of the State Architect. See Section 1.9.3 for additional scope provisions.
13. General acute care hospitals, acute psychiatric hospitals, skilled nursing and/or intermediate care facilities, clinics licensed by the Department of Public Health and correctional treatment centers regulated by the Office of Statewide Health Planning and Development. See Section 1.10 for additional scope provisions.
14. Applications regulated by the Office of the State Fire Marshal include, but are not limited to, the following in accordance with Section 1.11:

14.1. Buildings or structures used or intended for use as an:

1. Asylum, jail, prison
2. Mental hospital, hospital, home for the elderly, children's nursery, children's home or institution, school or any similar occupancy of any capacity
3. Theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education
4. Small family day-care homes, large family day-care homes, residential facilities and residential facilities for the elderly, residential care facilities
5. State institutions or other state-owned or state-occupied buildings
6. High rise structures
7. Motion picture production studios
8. Organized camps
9. Residential structures

14.2. Tents, awnings or other fabric enclosures used in connection with any occupancy

14.3. Fire alarm devices, equipment and systems in connection with any occupancy

14.4. Hazardous materials, flammable and combustible liquids

14.5. Public school automatic fire detection, alarm and sprinkler systems

14.6. Wildland-urban interface fire areas

15. Public libraries constructed and renovated using funds from the California Library Construction and Renovation Bond Act of 1988 and regulated by the State Librarian. See Section 1.12 for additional scope provisions.

16. Graywater systems regulated by the Department of Water Resources. See Section 1.13 for additional scope provisions.

17. For applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance, outdoor environments and uses shall be classified according to accessibility uses described in Chapters 11B.

18. Marine Oil Terminals regulated by the California State Lands Commission. See Section 1.14 for additional scope provisions.

**1.1.4 Appendices.** Provisions contained in the appendices of this code shall not apply unless specifically adopted by a state agency or adopted by a local enforcing agency in compliance with Health and Safety Code Section 18901 et. seq. for Building Standards Law, Health and Safety Code Section 17950 for State Housing Law and Health and Safety Code Section 13869.7 for Fire Protection Districts. See Section 1.1.8 of this code.

**1.1.5 Referenced codes.** The codes, standards and publications adopted and set forth in this code, including other codes, standards and publications referred to therein are, by title and date of publication, hereby adopted as standard reference documents of this code. When this code does not specifically cover any subject related to building design and construction, recognized architectural or engineering practices shall be employed. The National Fire Codes, standards, and the Fire Protection Handbook of the National Fire Protection Association are permitted to be used as authoritative guides in determining recognized fire prevention engineering practices.

**1.1.6 Nonbuilding standards, orders and regulations.** Requirements contained in the California Building Code, or in any other referenced standard, code or document, which are not building standards as defined in Health and Safety Code Section 18909, shall not be construed as part of the provisions of this code. For nonbuilding standards, orders and regulations, see other titles of the California Code of Regulations.

**1.1.7 Order of precedence and use.**

**1.1.7.1 Differences.** In the event of any differences between these building standards and the standard refer-

ence documents, the text of these building standards shall govern.

**1.1.7.2 Specific provisions.** Where a specific provision varies from a general provision, the specific provision shall apply.

**1.1.7.3 Conflicts.** When the requirements of this code conflict with the requirements of any other part of the California Building Standards Code, Title 24, the most restrictive requirements shall prevail.

**1.1.8 City, county, or city and county amendments, additions or deletions.** The provisions of this code do not limit the authority of city, county, or city and county governments to establish more restrictive and reasonably necessary differences to the provisions contained in this code pursuant to complying with Section 1.1.8.1. The effective date of amendments, additions or deletions to this code by a city, county, or city and county filed pursuant to Section 1.1.8.1 shall be the date filed. However, in no case shall the amendments, additions or deletions to this code be effective any sooner than the effective date of this code.

Local modifications shall comply with Health and Safety Code Section 18941.5 for Building Standards Law, Health and Safety Code Section 17958 for State Housing Law or Health and Safety Code Section 13869.7 for Fire Protection Districts.

#### **1.1.8.1 Findings and filings.**

1. The city, county, or city and county shall make express findings for each amendment, addition or deletion based upon climatic, topographical or geological conditions.

**Exception:** Hazardous building ordinances and programs mitigating unreinforced masonry buildings.

2. The city, county, or city and county shall file the amendments, additions or deletions expressly marked and identified as to the applicable findings. Cities, counties, cities and counties, and fire departments shall file the amendments, additions or deletions, and the findings with the California Building Standards Commission at 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833.
3. Findings prepared by fire protection districts shall be ratified by the local city, county or city and county and filed with the California Department of Housing and Community Development, Division of Codes and Standards, P.O. Box 1407, Sacramento, CA 95812-1407 or 1800 3rd Street, Room 260, Sacramento, CA 95811.

**1.1.9 Effective date of this code.** Only those standards approved by the California Building Standards Commission that are effective at the time an application for building permit is submitted shall apply to the plans and specifications for, and to the construction performed under, that permit. For the effective dates of the provisions contained in this code, see the History Note page of this code.

**1.1.10 Availability of codes.** At least one complete copy each of Titles 8, 19, 20, 24 and 25 with all revisions shall be maintained in the office of the building official responsible for the administration and enforcement of this code. Each state department concerned and each city, county, or city and county shall have an up-to-date copy of the code available for public inspection. See Health and Safety Code Section 18942(d)(1) and (2).

**1.1.11 Format.** This part fundamentally adopts the International Building Code by reference on a chapter-by-chapter basis. When a specific chapter of the International Building Code is not printed in the code and is marked "Reserved", such chapter of the International Building Code is not adopted as a portion of this code. When a specific chapter of the International Building Code is marked "Not adopted by the State of California" but appears in the code, it may be available for adoption by local ordinance.

**Note:** Matrix Adoption Tables at the front of each chapter may aid the code user in determining which chapter or sections within a chapter are applicable to buildings under the authority of a specific state agency, but they are not to be considered regulatory.

**1.1.12 Validity.** If any chapter, section, subsection, sentence, clause or phrase of this code is for any reason held to be unconstitutional, contrary to statute, exceeding the authority of the state as stipulated by statutes or otherwise inoperative, such decision shall not affect the validity of the remaining portion of this code.

## **SECTION 1.2**

### **BUILDING STANDARDS COMMISSION**

**1.2.1** Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

#### **1. State buildings for all occupancies.**

**Application**—State buildings (all occupancies), including buildings constructed by the Trustees of the California State University and the Regents of the University of California where no state agency has the authority to adopt building standards applicable to such buildings.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Health and Safety Code Section 18934.6.

**Reference**—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

#### **2. University of California, California State Universities and California Community Colleges.**

**Application**—Standards for lighting for parking lots and primary campus walkways at the University of California, California State Universities and California Community Colleges.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Government Code Section 14617.

**Reference**—Government Code Section 14617.

**3. Existing state-owned buildings, including those owned by the University of California and by the California State University.**

**Application**—Building seismic retrofit standards including abating falling hazards of structural and nonstructural components and strengthening of building structures. See also Division of the State Architect.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Health and Safety Code Section 16600.

**Reference**—Health and Safety Code Sections 16600 through 16604.

**4. Unreinforced masonry-bearing wall buildings.**

**Application**—Minimum seismic strengthening standards for buildings specified in Appendix Chapter A1 of the California Existing Building Code, except for buildings subject to building standards adopted pursuant to Health and Safety Code (commencing) with Section 17910.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Health and Safety Code Section 18934.6.

**Reference**—Health and Safety Code Sections 18901 through 18949.

**1.2.1.1 State building.** For purposes of this code, a “state building” is a structure for which a state agency or state entity has authority to construct, alter, enlarge, replace, repair or demolish.

**1.2.1.2 Enforcement.** [CSU, UC, Judicial Council and CDCR] State agencies or state entities authorized to construct state buildings may appoint a building official who is responsible to the agency for enforcement of the provisions of the California Building Standards Code.

**Exception:** State buildings regulated by other sections of this code remain the enforcement responsibility of the designated entities.

**1.2.1.3 Enforcement. Reserved for DGS.**

**1.2.2 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and

that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

**1.2.2.1 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**1.2.2.2 Tests.** Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

**1.2.3 Adopting agency identification.** The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym BSC.

## SECTION 1.3 BOARD OF STATE AND COMMUNITY CORRECTIONS

**1.3.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.**

**Application**—Local detention facilities.

**Enforcing agency**—Board of State and Community Corrections.

**Authority cited**—Penal Code Section 6030; Welfare and Institutions Code Sections 207.1, 210 and 885.

**Reference**—Penal Code Section 6030; Welfare and Institutions Code Sections 207.1, 210 and 885.

**1.3.2 Adopting agency identification.** The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym BSCC.

## SECTION 1.4 DEPARTMENT OF CONSUMER AFFAIRS

**1.4.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.**

**1. Board of Barbering and Cosmetology.**



**Application**—Any establishment or mobile unit where barbering, cosmetology or electrolysis is being performed.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Business and Professions Code Section 7312.

**Reference**—Business and Professions Code Sections 7303, 7303.1, 7312 and 7313.

## 2. Acupuncture Board.

**Application**—Acupuncture offices.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Business and Professions Code Section 4933.

**Reference**—Business and Professions Code Sections 4928, 4928.1 and 4933.

## 3. Board of Pharmacy.

**Application**—Pharmacies.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Business and Professions Code Section 4005.

**Reference**—Business and Professions Code Sections 4005, 4127.7 and 4201.

## 4. Veterinary Medical Board.

**Application**—Veterinary facilities.

**Enforcing agency**—State or local agency specified by the applicable provisions of law.

**Authority cited**—Business and Professions Code Section 4808.

**Reference**—Business and Professions Code Sections 4800, 4800.1, 4808 and 4809.5.

## 5. Structural Pest Control Board.

**Application**—Structural pest control locations.

**Enforcing agency**—Structural Pest Control Board.

**Authority cited**—Business and Professions Code Section 8525.

**Reference**—Business and Professions Code Sections 8520, 8520.1 and 8525.

**1.4.2 Adopting agency identification.** The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym CA.

### SECTION 1.5 Reserved

### SECTION 1.6 DEPARTMENT OF FOOD AND AGRICULTURE

**1.6.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.**

**Application**—Dairies and places of meat and poultry inspection.

**Enforcing agency**—Department of Food and Agriculture.

**Authority cited**—Food and Agricultural Code Sections 18735, 18960, 19384, 33481 and 33731.

**Reference**—Food and Agricultural Code Sections 18735, 18960, 19384, 33481 and 33731.

**1.6.2 Adopting agency identification.** The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym AGR.

### SECTION 1.7 CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

**1.7.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.**

**California Department of Public Health**

**Application**—Organized camps, laboratory animal quarters, public swimming pools, radiation protection and producing facilities, commissaries serving mobile food preparation vehicles, wild animal quarantine facilities, shellfish facilities and food establishments.

**Enforcing agency**—The California Department of Public Health and the local health agencies.

**Authority cited**—Health and Safety Code Sections 1660, 18897.2, 110065, 112165, 113710, 114304, 115061, 116050, 121795 and 131200.

**Reference**—Health and Safety Code Sections 1650, 1660, 18897.2, 18897.4, 18897.7, 100150, 110065, 113705, 113710, 114825, 114965, 115061, 116050, 116503, 112165, 121795 and 131200.

**1.7.2 Adopting agency identification.** The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym DPH.

### SECTION 1.8 DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

**1.8.1 Purpose.** The purpose of this code is to establish the minimum requirements necessary to protect the health, safety and general welfare of the occupants and the public by governing accessibility, erection, construction, reconstruction, enlargement, conversion, alteration, repair, moving, removal, demolition, occupancy, use, height, court, area, sanitation, ventilation, maintenance and safety to life and property from fire and other hazards attributed to the built environment.

## SECTION 1.8.2

### AUTHORITY AND ABBREVIATIONS

**1.8.2.1 General.** The Department of Housing and Community Development is authorized by law to promulgate and adopt building standards and regulations for several types of building applications. The applications under the authority of the Department of Housing and Community Development are listed in Sections 1.8.2.1.1 through 1.8.2.1.3.

**Note:** See the California Residential Code for detached one- and two-family dwellings and townhouses.

#### 1.8.2.1.1 Housing construction.

**Application**—Hotels, motels, lodging houses, apartment houses, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities including accessory buildings, facilities, and uses thereto. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 1.”

**Enforcing agency**—Local building department or the Department of Housing and Community Development.

**Authority cited**—Health and Safety Code Sections 17040, 17050, 17920.9, 17921, 17921.3, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17927, 17928, 17959.6, 18300, 18552, 18554, 18620, 18630, 18640, 18670, 18690, 18691, 18865, 18871.3, 18871.4, 18873, 18873.1, 18873.2, 18873.3, 18873.4, 18873.5, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

**Reference**—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, and Sections 19960 through 19997; and Government Code Sections 12955.1 and 12955.1.1.

#### 1.8.2.1.2 Housing accessibility.

**Application**—“COVERED MULTIFAMILY DWELLINGS” as defined in Chapter 11A including, but not limited to, lodging houses, dormitories, timeshares, condominiums, shelters for homeless persons, congregate residences, apartment houses, dwellings, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities.

Sections of this code identified by the abbreviation “HCD 1-AC” require specific accommodations for “PERSONS WITH DISABILITIES” as defined in Chapter 11A. The application of such provisions shall be in conjunction with other requirements of this code and apply only to newly constructed “COVERED MULTIFAMILY DWELLINGS” as defined in Chapter 11A of the California Building

Code. “HCD 1-AC” applications include, but are not limited to, the following:

1. All newly constructed “COVERED MULTIFAMILY DWELLINGS” as defined in Chapter 11A.
2. New “COMMON USE AREAS” as defined in Chapter 11A serving existing covered multifamily dwellings.
3. Additions to existing buildings, where the addition alone meets the definition of “COVERED MULTIFAMILY DWELLINGS” as defined in Chapter 11A.
4. Common use areas serving covered multifamily dwellings.
5. Where any portion of a building’s exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings, the building is considered a new building for determining the application of Chapter 11A.

“HCD 1-AC” building standards generally do not apply to public use areas or public accommodations such as hotels and motels. Public use areas, public accommodations and public housing as defined in Chapter 2 of this code are subject to the Division of the State Architect (DSA-AC) and are referenced in Section 1.9.1.

**Enforcing agency**—Local building department or the Department of Housing and Community Development.

**Authority cited**—Health and Safety Code Sections 17040, 17050, 17920.9, 17921, 17921.3, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17927, 17928, 17959.6, 18300, 18552, 18554, 18620, 18630, 18640, 18670, 18690, 18691, 18865, 18871.3, 18871.4, 18873, 18873.1, 18873.2, 18873.3, 18873.4, 18873.5, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

**Reference**—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, and 19960 through 19997; and Government Code Sections 12955.1 and 12955.1.1.

#### 1.8.2.1.3 Permanent buildings in mobilehome parks and special occupancy parks.

**Application**—Permanent buildings, and permanent accessory buildings or structures, constructed within mobilehome parks and special occupancy parks that are under the control and ownership of the park operator. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 2.”

**Enforcing agency**—The Department of Housing and Community Development, local building department or other local agency that has assumed responsibility for the enforcement of Health and

Safety Code, Division 13, Part 2.1 commencing with Section 18200 for mobilehome parks and Health and Safety Code, Division 13, Part 2.3 commencing with Section 18860 for special occupancy parks.

**Authority cited**—Health and Safety Code Sections 17040, 17050, 17920.9, 17921, 17921.3, 17921.6, 17821.10, 17922, 17922.6, 17922.12, 17927, 17928, 17959.6, 18300, 18552, 18554, 18620, 18630, 18640, 18670, 18690, 18691, 18865, 18871.3, 18871.4, 18873, 18873.1, 18873.2, 18873.3, 18873.4, 18873.5, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

**Reference**—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, and 19960 through 19997; and Government Code Sections 12955.1 and 12955.1.1.

### SECTION 1.8.3 LOCAL ENFORCING AGENCY

**1.8.3.1 Duties and powers.** The building department of every city, county, or city and county, shall enforce all the provisions of law, this code, and the other rules and regulations promulgated by the Department of Housing and Community Development pertaining to the installation, erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartment houses, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

The provisions regulating the erection and construction of dwellings and appurtenant structures shall not apply to existing structures as to which construction is commenced or approved prior to the effective date of these regulations. Requirements relating to use, maintenance and occupancy shall apply to all dwellings and appurtenant structures approved for construction or constructed before or after the effective date of this code.

For additional information regarding the use and occupancy of existing buildings and appurtenant structures, see California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Article 1, Section 1.

**1.8.3.2 Laws, rules and regulations.** Other than the building standards contained in this code, and notwithstanding other provisions of law, the statutory authority and location of the laws, rules and regulations to be enforced by local enforcing agencies are listed by statute in Sections 1.8.3.2.1 through 1.8.3.2.5 below:

**1.8.3.2.1 State Housing Law.** Refer to the State Housing Law, California Health and Safety Code, Division 13, Part 1.5 commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1, for the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartment houses, hotels, motels, lodging

houses and dwellings, including accessory buildings, facilities and uses thereto.

**1.8.3.2.2 Mobilehome Parks Act.** Refer to the Mobilehome Parks Act, California Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000 for mobilehome park administrative and enforcement authority, permits, plans, fees, violations, inspections and penalties both within and outside mobilehome parks.

**Exception:** Mobilehome parks where the Department of Housing and Community Development is the enforcing agency.

**1.8.3.2.3 Special Occupancy Parks Act.** Refer to the Special Occupancy Parks Act, California Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000 for special occupancy park administrative and enforcement authority, permits, fees, violations, inspections and penalties both within and outside of special occupancy parks.

**Exception:** Special occupancy parks where the Department of Housing and Community Development is the enforcing agency.

**1.8.3.2.4 Employee Housing Act.** Refer to the Employee Housing Act, California Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600 for employee housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

**1.8.3.2.5 Factory-Built Housing Law.** Refer to the Factory-Built Housing Law, California Health and Safety Code, Division 13, Part 6 commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000 for factory-built housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

### SECTION 1.8.4 PERMITS, FEES, APPLICATIONS AND INSPECTIONS

**1.8.4.1 Permits.** A written construction permit shall be obtained from the enforcing agency prior to the erection, construction, reconstruction, installation, moving or alteration of any building or structure.

**Exceptions:**

1. Work exempt from permits as specified in Chapter 1, Division II, Scope and Administration, Section 105.2.
2. Changes, alterations or repairs of a minor nature not affecting structural features, egress, sanitation, safety or accessibility as determined by the enforcing agency.

Exemptions from permit requirements shall not be deemed to grant authorization for any work to be done in any manner in violation of other provisions of law or this code.

**1.8.4.2 Fees.** Subject to other provisions of law, the governing body of any city, county, or city and county, may prescribe fees to defray the cost of enforcement of rules and regulations promulgated by the Department of Housing and Community Development. The amount of the fees shall not exceed the amount reasonably necessary to administer or process permits, certificates, forms or other documents, or to defray the costs of enforcement. For additional information, see the State Housing Law, Health and Safety Code, Division 13, Part 1.5, Section 17951 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, Article 3, commencing with Section 6.

**1.8.4.3 Plan review and time limitations.** Subject to other provisions of law, provisions related to plan checking, prohibition of excessive delays and contracting with or employment of private parties to perform plan checking are set forth in the State Housing Law, Health and Safety Code Section 17960.1, and for employee housing, in Health and Safety Code Section 17021.

**1.8.4.3.1 Retention of plans.** The building department of every city, county, or city and county shall maintain an official copy, microfilm, electronic or other type of photographic copy of the plans of every building, during the life of the building, for which the department issued a building permit.

**Exceptions:**

1. Single or multiple dwellings not more than two stories and basement in height.
2. Garages and other structures appurtenant to buildings listed in Exception 1.
3. Farm or ranch buildings appurtenant to buildings listed in Exception 1.
4. Any one-story building where the span between bearing walls does not exceed 25 feet (7620 mm), except a steel frame or concrete building.

All plans for common interest developments as defined in Section 1351 of the California Civil Code shall be retained. For additional information regarding plan retention and reproduction of plans by an enforcing agency, see Health and Safety Code Sections 19850 through 19852.

**1.8.4.4 Inspections.** Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or other regulations of the Department of Housing and Community Development. Required inspections are listed in Chapter 1, Division II, Scope and Administration, Sections 110.3.1 through 110.3.6, 110.3.8, 110.3.9 and 110.3.10.

## **SECTION 1.8.5 RIGHT OF ENTRY FOR ENFORCEMENT**

**1.8.5.1 General.** Subject to other provisions of law, officers and agents of the enforcing agency may enter and inspect public and private properties to secure compliance with the rules and regulations promulgated by the Department of Housing and Community Development. For limitations and additional information regarding enforcement, see the following:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

## **SECTION 1.8.6 LOCAL MODIFICATION BY ORDINANCE OR REGULATION**

**1.8.6.1 General.** Subject to other provisions of law, a city, county, or city and county may make changes to the provisions adopted by the Department of Housing and Community Development. If any city, county, or city and county does not amend, add or repeal by local ordinances or regulations the provisions published in this code or other regulations promulgated by the Department of Housing and Community Development, those provisions shall be applicable and shall become effective 180 days after publication by the California Building Standards Commission. Amendments, additions and deletions to this code adopted by a city, county, or city and county pursuant to California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5, together with all applicable portions of this code, shall also become effective 180

days after publication of the California Building Standards Code by the California Building Standards Commission.

**1.8.6.2 Findings, filings and rejections of local modifications.** Prior to making any modifications or establishing more restrictive building standards, the governing body shall make express findings and filings, as required by California Health and Safety Code Section 17958.7, showing that such modifications are reasonably necessary due to local climatic, geological or topographical conditions. No modification shall become effective or operative unless the following requirements are met:

1. The express findings shall be made available as a public record.
2. A copy of the modification and express finding, each document marked to cross-reference the other, shall be filed with the California Building Standards Commission for a city, county, or city and county and with the Department of Housing and Community Development for fire protection districts.
3. The California Building Standards Commission has not rejected the modification or change.

Nothing in this section shall limit the authority of fire protection districts pursuant to California Health and Safety Code Section 13869.7(a).

## SECTION 1.8.7 ALTERNATE MATERIALS, DESIGNS, TESTS AND METHODS OF CONSTRUCTION

**1.8.7.1 General.** The provisions of this code, as adopted by the Department of Housing and Community Development, are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, design or method of construction not specifically prescribed by this code. Consideration and approval of alternates shall comply with Section 1.8.7.2 for local building departments and Section 1.8.7.3 for the Department of Housing and Community Development.

**1.8.7.2 Local building departments.** The building department of any city, county, or city and county may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of an apartment house, hotel, motel, lodging house, dwelling or an accessory structure, except for the following:

1. Structures located in mobilehome parks as defined in California Health and Safety Code Section 18214.
2. Structures located in special occupancy parks as defined in California Health and Safety Code Section 18862.43.
3. Factory-built housing as defined in California Health and Safety Code Section 19971.

**1.8.7.2.1 Approval of alternates.** The consideration and approval of alternates by a local building department shall comply with the following procedures and limitations:

1. The approval shall be granted on a case-by-case basis.
2. Evidence shall be submitted to substantiate claims that the proposed alternate, in performance, safety and protection of life and health, conforms to, or is at least equivalent to, the standards contained in this code and other rules and regulations promulgated by the Department of Housing and Community Development.
3. The local building department may require tests performed by an approved testing agency at the expense of the owner or owner's agent as proof of compliance.
4. If the proposed alternate is related to accessibility in covered multifamily dwellings or in facilities serving "COVERED MULTIFAMILY DWELLINGS" as defined in Chapter 11A, the proposed alternate must also meet the threshold set for "EQUIVALENT FACILITATION" as defined in Chapter 11A.

For additional information regarding approval of alternates by a building department pursuant to the State Housing Law, see California Health and Safety Code Section 17951(e) and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

**1.8.7.3 Department of Housing and Community Development.** The Department of Housing and Community Development may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal or demolition of an apartment house, hotel, motel, lodging house, dwelling or an accessory thereto and permanent buildings in mobilehome parks and special occupancy parks. The consideration and approval of alternates shall comply with the following:

1. The department may require tests at the expense of the owner or owner's agent to substantiate compliance with the California Building Standards Code.
2. The approved alternate shall, for its intended purpose, be at least equivalent in performance and safety to the materials, designs, tests or methods of construction prescribed by this code.

## SECTION 1.8.8 APPEALS BOARD

**1.8.8.1 General.** Every city, county, or city and county shall establish a process to hear and decide appeals of orders, decisions and determinations made by the enforcing agency relative to the application and interpretation of this code and other regulations governing use, maintenance and change of occupancy. The governing body of any city, county, or city and county may establish a local appeals board and a housing appeals board to serve this purpose. Members of the appeals board(s) shall not be employees of the enforcing agency and shall be knowledgeable in the applicable building codes, regulations and ordinances as determined by the governing body of the city, county, or city and county.

Where no such appeals boards or agencies have been established, the governing body of the city, county, or city and county shall serve as the local appeals board or housing appeals board as specified in California Health and Safety Code Sections 17920.5 and 17920.6.

**1.8.8.2 Definitions.** The following terms shall for the purposes of this section have the meaning shown.

**HOUSING APPEALS BOARD.** The board or agency of a city, county, or city and county which is authorized by the governing body of the city, county, or city and county to hear appeals regarding the requirements of the city, county, or city and county relating to the use, maintenance and change of occupancy of buildings and structures, including requirements governing alteration, additions, repair, demolition and moving. In any area in which there is no such board or agency, "Housing appeals board" means the local appeals board having jurisdiction over the area.

**LOCAL APPEALS BOARD.** The board or agency of a city, county, or city and county which is authorized by the governing body of the city, county, or city and county to hear appeals regarding the building requirements of the city, county, or city and county. In any area in which there is no such board or agency, "Local appeals board" means the governing body of the city, county, or city and county having jurisdiction over the area.

**1.8.8.3 Appeals.** Except as otherwise provided in law, any person, firm or corporation adversely affected by a decision, order or determination by a city, county, or city and county relating to the application of building standards published in the California Building Standards Code, or any other applicable rule or regulation adopted by the Department of Housing and Community Development, or any lawfully enacted ordinance by a city, county, or city and county, may appeal the issue for resolution to the local appeals board or housing appeals board as appropriate.

The local appeals board shall hear appeals relating to new building construction and the housing appeals board shall hear appeals relating to existing buildings.

## SECTION 1.8.9 UNSAFE BUILDINGS OR STRUCTURES

**1.8.9.1 Authority to enforce.** Subject to other provisions of law, the administration, enforcement, actions, proceedings, abatement, violations and penalties for unsafe buildings and structures are contained in the following statutes and regulations:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, com-

mencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.

3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

**1.8.9.2 Actions and proceedings.** Subject to other provisions of law, punishments, penalties and fines for violations of building standards are contained in the following statutes and regulations:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.



## SECTION 1.8.10 OTHER BUILDING REGULATIONS

**1.8.10.1 Existing structures.** Subject to the requirements of California Health and Safety Code Sections 17912, 17920.3, 17922, 17922.3, 17958.8 and 17958.9, the provisions contained in Chapter 34 relating to existing structures shall only apply as identified in the Matrix Adoption Table under the authority of the Department of Housing and Community Development as listed in Sections 1.8.2.1.1 through 1.8.2.1.3 of this code.

**1.8.10.2 Moved structures.** Subject to the requirements of California Health and Safety Code Sections 17922.3 and 17958.9, the provisions contained in Chapter 34 relating to a moved residential structure shall only apply as identified in the Matrix Adoption Table under the authority of the Department of Housing and Community Development as listed in Sections 1.8.2.1.1 through 1.8.2.1.3 of this code.

## SECTION 1.9 DIVISION OF THE STATE ARCHITECT

### 1.9.1 Division of the State Architect—Access Compliance.

**General.** The purpose of this code is to ensure that barrier-free design is incorporated in all buildings, facilities, site work and other improvements to which this code applies in compliance with state law to ensure that these improvements are accessible to and usable by persons with disabilities. Additions, alterations and structural repairs in all buildings and facilities shall comply with these provisions for new buildings, except as otherwise provided and specified herein.

The provisions of these regulations shall apply to any portable buildings leased or owned by a school district, and shall also apply to temporary and emergency buildings and facilities. Temporary buildings and facilities are not of permanent construction but are extensively used or are essential for public use for a period of time. Examples of temporary buildings or facilities covered include, but are not limited to: reviewing stands, temporary classrooms, bleacher areas, exhibit areas, temporary banking facilities, temporary health screening services or temporary safe pedestrian passageways around a construction site.

In addition, to incorporate standards at least as restrictive as those required by the federal government for barrier-free design under (1) Title III (Public Accommodations and Commercial Facilities), Subpart D (New Construction and Alteration) (see 28 C.F.R., Part 36), and (2) Title II (Public Entities), Section 35.151 (New Construction and Alterations) (see 28 C.F.R., Part 35) both from the Americans with Disabilities Act of 1990, 2004 Americans with Disabilities Act Accessibility Guidelines, as adopted by the U.S. Department of Justice (see 36 C.F.R. Part 1191, Appendices B and D), and (3) under the Fair Housing Amendments Act of 1988. Some of these regulations may be more stringent than state law in order to meet the federal requirement.

**1.9.1.1 Application.** See Government Code commencing with Section 4450.

Publicly funded buildings, structures, sidewalks, curbs and related facilities shall be accessible to and usable by persons with disabilities as follows:

**1.9.1.1.1** All buildings, structures, sidewalks, curbs and related facilities constructed in the state by the use of state, county or municipal funds, or the funds of any political subdivision of the state.

**1.9.1.1.2** All buildings, structures and facilities that are leased, rented, contracted, sublet or hired by any municipal, county or state division of government, or by a special district.

**1.9.1.1.3** All publicly funded buildings used for congregate residences or for one- or two-family dwelling unit purposes shall conform to the provisions applicable to living accommodations.

**1.9.1.1.4** All existing publicly funded buildings and facilities when alterations, structural repairs or additions are made to such buildings or facilities. For detailed requirements on existing buildings, see Chapter 11B, Division 2, Section 11B-202.

**1.9.1.1.5** With respect to buildings, structures, sidewalks, curbs and related facilities not requiring a building permit, building standards published in the California Building Standards Code relating to access for persons with disabilities and other regulations adopted pursuant to Government Code Section 4450, and in effect at the time construction is commenced, shall be applicable.

**1.9.1.2 Application.** See Health and Safety Code commencing with Section 19952.

All privately funded public accommodations, as defined and commercial facilities, as defined, shall be accessible to persons with disabilities as follows:

**Exception:** Certain types of privately funded multistory buildings do not require installation of an elevator to provide access above and below the first floor. See Chapter 11B.

**1.9.1.2.1** Any building, structure, facility, complex or improved area, or portions thereof, which are used by the general public.

**1.9.1.2.2** Any sanitary facilities which are made available for the public, clients or employees in such accommodations or facilities.

**1.9.1.2.3** Any curb or sidewalk intended for public use that is constructed in this state with private funds.

**1.9.1.2.4** All existing privately funded public accommodations when alterations, structural repairs or additions are made to such public accommodations as set forth under Chapter 11B.

**1.9.1.3 Application—**Public housing and private housing available for public use. See Government Code Sections 4450 and 12955.1(c).

**1.9.1.4 Enforcing agency.**

**1.9.1.4.1** The director of the Department of General Services where state funds are utilized for any project

or where funds of counties, municipalities or other political subdivisions are utilized for the construction of elementary, secondary or community college projects.

**1.9.1.4.2** The governing bodies where funds of counties, municipalities or other political subdivisions are utilized except as otherwise provided above.

**1.9.1.4.3** The building department of every city, county or city and county within the territorial area of its city, county or city and county, where private funds are utilized. "Building department" means the department, bureau or officer charged with the enforcement of laws or ordinances regulating the erection or construction, or both the erection and construction, of buildings.

**1.9.1.5** Special conditions for persons with disabilities requiring appeals action ratification. Whenever reference is made in these regulations to this section, the findings and determinations required to be rendered by the local enforcing agency shall be subject to ratification through an appeals process.

**1.9.1.6 Authority cited**—Government Code Section 4450.

**1.9.1.7 Reference cited**—Government Code Sections 4450 through 4461 and 12955.1(c) and Health and Safety Code Sections 18949.1, 19952 through 19959.

**1.9.1.8 Adopting agency identification.** The provisions of this code applicable to buildings identified in this Subsection 1.9.1 will be identified in the Matrix Adoption Tables under the acronym DSA-AC.

## **1.9.2 Division of the State Architect—Structural Safety.**

### **1.9.2.1 DSA-SS Division of the State Architect-Structural Safety.**

**Application**—Public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

**Enforcing agency**—The Division of the State Architect—Structural Safety (DSA-SS) has been delegated the responsibility and authority by the Department of General Services to review and approve the design and observe the construction of public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

**Authority cited**—Education Code Sections 17310 and 81142 and Health and Safety Code Section 16022.

**Reference**—Education Code Sections 17280 through 17317, and 81130 through 81147 and Health and Safety Code Sections 16000 through 16023.

#### **1.9.2.1.1 Applicable administrative standards.**

##### **1. Title 24, Part 1, California Code of Regulations:**

- 1.1. Sections 4-301 through 4-355, Group 1, Chapter 4, for public elementary and secondary schools and community colleges.
- 1.2. Sections 4-201 through 4-249, Chapter 4, for state-owned or state-leased essential services buildings.

##### **2. Title 24, Part 2, California Code of Regulations:** [applies to public elementary and secondary schools, community colleges and state-owned or state-leased essential services building(s)]:

2.1. Sections 1.1 and 1.9.2.1 of Chapter 1, Division I.

2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 104.9, 104.10 104.11 and 106.1 of Chapter 1, Division II.

**1.9.2.1.2 Applicable building standards.** California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 11 and 12, California Code of Regulations, for school buildings, community colleges and state-owned or state-leased essential service buildings.

The provisions of Title 24, Part 2, as adopted and amended by the Division of the State Architect—Structural Safety, shall apply to the applications listed in Section 1.9.2.1.

The Division of the State Architect—Structural Safety adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16A, 17A, 18A, 19A, 20, 21A, 22A, 23, 24, 25, 26, 30, 31, 32, 33, 34, 35, and Appendix J.

**1.9.2.1.3 Amendments.** Division of the State Architect—Structural Safety amendments in this code appear preceded with the acronym [DSA-SS].

#### **Exceptions:**

1. Chapters 16A, 17A, 18A, 19A, 21A, and 22A—Amendments appearing in these chapters without an acronym have been co-adopted by DSA-SS and OSHPD.
2. Chapter 34, Sections 3417-3423—DSA-SS adopts these sections without the use of the DSA-SS acronym.

**1.9.2.1.4 Reference to other chapters.** Where reference is made within this code to sections in Chapters 16, 17, 18, 19, 21, and 22, the respective sections in Chapters 16A, 17A, 18A, 19A, 21A, and 22A shall apply instead.

### **1.9.2.2 DSA-SS/CC Division of the State Architect-Structural Safety/Community Colleges**

**Application**—Community Colleges. The Division of the State Architect has been delegated the authority by the Department of General Services to promulgate alternate building standards for application to community colleges, which a community college may elect to use in lieu of standards promulgated by DSA-SS in accordance with Section 1.9.2.1.

**Enforcing agency**—Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC)

The Division of the State Architect has been delegated the authority by the Department of General Services to review and approve the design and oversee construction of community colleges electing to use the

alternative building standards as provided in this section.

**Authority cited**—Education Code Section 81053.

**Reference**—Education Code Sections 81052, 81053, and 81130 through 81147.

#### **1.9.2.2.1 Applicable administrative standards.**

##### **1. Title 24, Part 1, California Code of Regulations:**

- 1.1. Sections 4-301 through 4-355, Group 1, Chapter 4.

##### **2. Title 24, Part 2, California Code of Regulations:**

- 2.1. Sections 1.1 and 1.9.2 of Chapter 1, Division I.
- 2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 104.9, 104.10, 104.11, and 106.1 of Chapter 1, Division II.

**1.9.2.2.2 Applicable building standards.** California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 11, and 12, California Code of Regulations.

The Division of the State Architect-Structural Safety/Community Colleges [DSA-SS/CC] adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16, 17A, 18A, 19, 20, 21, 22, 23, 24, 25, 26, 30, 31, 32, 33, 34, 35, and Appendix J.

**1.9.2.2.3 Amendments.** Division of the State Architect—Structural Safety/Community Colleges amendments in this code appear preceded with the acronym [DSA-SS/CC].

#### **Exceptions:**

1. Chapters 17A, and 18A—Amendments appearing in these chapters without an acronym have been co-adopted by DSA-SS, DSA-SS/CC, and OSHPD.
2. Chapter 34, Sections 3417-3423—DSA-SS/CC adopts these sections without the use of the DSA-SS/CC acronym.

**1.9.2.2.4 Reference to other chapters.** Where reference is made within this code to sections in Chapters 17 and 18, the respective sections in Chapters 17A and 18A shall apply instead.

## **SECTION 1.10 OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT**

**1.10.1 OSHPD 1.** Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application**—General acute care hospitals and acute psychiatric hospitals, excluding distinct part units or distinct part freestanding buildings providing skilled nursing or intermediate care services. For structural regulations: Skilled nursing facilities and/or intermediate care facilities

except those skilled nursing facilities and intermediate care facilities of single-story, Type V, wood or light steel-frame construction.

**Enforcing agency**—Office of Statewide Health Planning and Development (OSHPD). The office shall enforce the Division of the State Architect-Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above stated facility types.

#### **1.10.1.1 Applicable administrative standards.**

1. Title 24, Part 1, California Code of Regulations: Chapters 6 and 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and Sections 101–105.1.2, portions of Section 105.2 as indicated in the adoption matrix and Sections 105.3–116, Chapter 1, Division II.

**1.10.1.2 Applicable building standards.** California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 9 and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.1.

OSHPD 1 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16A, 17A, 18A, 19A, 20, 21A, 22A, 23, 24, 25, 26, 30, 31, 32, 33, 34A, 35, Appendix J and Appendix L.

**1.10.1.3 Identification of amendments.** For applications listed in Section 1.10.1, amendments appear in this code preceded with the acronym [OSHPD 1], unless the entire chapter is applicable.

**1.10.1.4 Reference to other chapters.** Where reference is made within this code to sections in Chapters 16, 17, 18, 19, 21, 22 and 34, the respective sections in Chapters 16A, 17A, 18A, 19A, 21A, 22A and 34A shall apply instead.

**Authority**—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

**References**—Health and Safety Code Sections 19958, 127010, 127015, 129680, 1275 and 129675 through 130070.

**1.10.2 OSHPD 2.** Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application**—Skilled nursing facilities and intermediate care facilities, including distinct part skilled nursing and intermediate care services on a general acute care or acute psychiatric hospital license, provided either are in a separate unit or a freestanding building. For structural regulations: Single-story, Type V skilled nursing facility and/or intermediate care facilities utilizing wood or light steel-frame construction.

**Enforcing agency**—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance

regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility type.

#### **1.10.2.1 Applicable administrative standards.**

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and Sections 101-103, portions of Section 104 and 105 as indicated in the adoption matrix and Sections 106-116, Chapter 1, Division II.

#### **1.10.2.2 Applicable building standards.** California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 9, and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.2.

OSHPD 2 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 30, 31, 32, 33, 34, 35, Appendices J and L.

#### **1.10.2.3 Identification of amendments.** For applications listed in Section 1.10.2, amendments appear in this code preceded with the acronym [OSHPD 2].

**Authority**—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

**References**—Health and Safety Code Sections 127010, 127015, 1275 and 129680.

#### **1.10.3 OSHPD 3.** Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application**—Licensed clinics and any freestanding building under a hospital license where outpatient clinical services are provided.

**Enforcing agency**—Local building department.

#### **1.10.3.1 Applicable administrative standards.**

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and portions of Section 101 as adopted, Sections 102-103, portions of Sections 104 -107 as indicated in the adoption matrix, and Sections 108-116, Chapter 1, Division II.

#### **1.10.3.2 Applicable building standards.** California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.3.

OSHPD 3 adopts the following building standards in Title 24, Part 2:

Chapter 12.

#### **1.10.3.3 Identification of amendments.** For applications listed in Section 1.10.3, amendments appear in this code without the acronym [OSHPD 3]. Adoptions are shown in the adoption matrix.

**Authority**—Health and Safety Code Sections 127010, 127015 and 1226.

**References**—Health and Safety Code Sections 127010, 127015, 129885 and 1226, Government Code Section 54350 and State Constitution Article 11, Section 7.

#### **1.10.4 OSHPD 4.** Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application**—Correctional treatment centers.

**Enforcing agency**—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

#### **1.10.4.1 Applicable administrative standards.**

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and Sections 101-105.1.2, portions of Section 105.2 as indicated in the adoption matrix and Sections 105.3-116, Chapter 1, Division II.

#### **1.10.4.2 Applicable building standards.** California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 9, and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.4.

OSHPD 4 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16A, 17A, 18A, 19A, 20, 21A, 22A, 23, 24, 25, 26, 30, 31, 32, 33, 34A, 35 and Appendices J and L.

#### **1.10.4.3 Identification of amendments.** For applications listed in Section 1.10.4, amendments appear in this code preceded with the acronym [OSHPD 4], unless the entire chapter is applicable.

#### **1.10.4.4 Reference to other chapters.** Where reference is made within this code to sections in Chapters 16, 17, 18, 19, 21, 22 and 34, the respective sections in Chapters 16A, 17A, 18A, 19A, 21A, 22A and 34A shall apply instead.

**Authority**—Health and Safety Code Sections 127010, 127015 and 129790.

**References**—Health and Safety Code Sections 127010, 127015, 1275 and 129675 through 130070.

## **SECTION 1.11 OFFICE OF THE STATE FIRE MARSHAL**

**1.11.1 SFM—Office of the State Fire Marshal.** Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application:**

**Institutional, educational or any similar occupancy.** Any building or structure used or intended for use as an asylum, jail, mental hospital, hospital, sanitarium, home for the aged, children's nursery, children's home, school or any similar occupancy of any capacity.

**Authority cited**—Health and Safety Code Section 13143.

**Reference**—Health and Safety Code Section 13143.

**Assembly or similar place of assemblage.** Any theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education.

**Authority cited**—Health and Safety Code Section 13143.

**Reference**—Health and Safety Code Section 13143.

**Small family day-care homes.**

**Authority cited**—Health and Safety Code Sections 1597.45, 1597.54, 13143 and 17921.

**Reference**—Health and Safety Code Section 13143.

**Large family day-care homes.**

**Authority cited**—Health and Safety Code Sections 1597.46, 1597.54 and 17921.

**Reference**—Health and Safety Code Section 13143.

**Residential facilities and residential facilities for the elderly.**

**Authority cited**—Health and Safety Code Section 13133.

**Reference**—Health and Safety Code Section 13143.

**Any state institution or other state-owned or state-occupied building.**

**Authority cited**—Health and Safety Code Section 13108.

**Reference**—Health and Safety Code Section 13143.

**High-Rise structures.**

**Authority cited**—Health and Safety Code Section 13211.

**Reference**—Health and Safety Code Section 13143.

**Motion picture production studios.**

**Authority cited**—Health and Safety Code Section 13143.1.

**Reference**—Health and Safety Code Section 13143.

**Organized camps.**

**Authority cited**—Health and Safety Code Section 18897.3.

**Reference**—Health and Safety Code Section 13143.

**Residential.** All hotels, motels, lodging houses, apartment houses and dwellings, including congregate residences and buildings and structures accessory thereto.

Multiple-story structures existing on January 1, 1975, let for human habitation, including and limited to, hotels, motels and apartment houses, less than 75 feet (22 860 mm) above the lowest floor level having building access, wherein rooms used for sleeping are let above the ground floor.

**Authority cited**—Health and Safety Code Sections 13143.2 and 17921.

**Reference**—Health and Safety Code Section 13143.

**Residential care facilities.** Certified family care homes, out-of-home placement facilities, halfway houses, drug and/or alcohol rehabilitation facilities and any building or structure used or intended for use as a home or institution for the housing of any person of any age when such person is referred to or placed within such home or institution for protective social care and supervision services by any governmental agency.

**Authority cited**—Health and Safety Code Section 13143.6.

**Reference**—Health and Safety Code Section 13143.

**Tents, awnings or other fabric enclosures used in connection with any occupancy.**

**Authority cited**—Health and Safety Code Section 13116.

**Reference**—Health and Safety Code Section 13143.

**Fire alarm devices, equipment and systems in connection with any occupancy.**

**Authority cited**—Health and Safety Code Section 13114.

**Reference**—Health and Safety Code Section 13143.

**Hazardous materials.**

**Authority cited**—Health and Safety Code Section 13143.9.

**Reference**—Health and Safety Code Section 13143.

**Flammable and combustible liquids.**

**Authority cited**—Health and Safety Code Section 13143.6.

**Reference**—Health and Safety Code Section 13143.

**Public School Automatic Fire Detection, Alarm and Sprinkler Systems.**

**Authority cited**—Health and Safety Code Section 13143 and California Education Code Article 7.5, Sections 17074.50, 17074.52 and 17074.54.

**Reference**—Government Code Section 11152.5, Health and Safety Code Section 13143 and California Education Code Chapter 12.5, Leroy F. Greene School Facilities Act of 1998, Article 1.

**Wildland-Urban Interface Fire Area.**

**Authority cited**—Health and Safety Code Sections 13143, 13108.5(a) and 18949.2(b) and (c) and Government Code Section 51189.

**Reference**—Health and Safety Code Sections 13143, Government Code Sections 51176, 51177, 51178 and 51179 and Public Resources Code Sections 4201 through 4204.

**1.11.1.1 Adopting agency identification.** The provisions of this code applicable to buildings identified in this Subsection 1.11.1 will be identified in the Matrix Adoption Tables under the acronym SFM.

## **1.11.2 Duties and powers of the enforcing agency.**

### **1.11.2.1 Enforcement.**

**1.11.2.1.1** The responsibility for enforcement of building standards adopted by the State Fire Marshal and published in the California Building Standards Code relating to fire and panic safety and other regulations of the State Fire Marshal shall, except as provided in Section 1.11.2.1.2, be as follows:

1. The city, county or city and county with jurisdiction in the area affected by the standard or regulation shall delegate the enforcement of the building standards relating to fire and panic safety and other regulations of the State Fire Marshal as they relate to Group R-3 occupancies, as described in Section 310.1 of Part 2 of the California Building Standards Code, to either of the following:
  - 1.1. The chief of the fire authority of the city, county or city and county, or an authorized representative.
  - 1.2. The chief building official of the city, county or city and county, or an authorized representative.
2. The chief of any city or county fire department or of any fire protection district, and authorized representatives, shall enforce within the jurisdiction the building standards and other regulations of the State Fire Marshal, except those described in Item 1 or 4.
3. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in areas outside of corporate cities and districts providing fire protection services.
4. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in corporate cities and districts providing fire protection services on request of the chief fire official or the governing body.
5. Any fee charged pursuant to the enforcement authority of this section shall not exceed the estimated reasonable cost of providing the service for which the fee is charged pursuant to Section 66014 of the Government Code.

**1.11.2.1.2** Pursuant to Health and Safety Code Section 13108, and except as otherwise provided in this section, building standards adopted by the State Fire Marshal published in the California Building Standards

Code relating to fire and panic safety shall be enforced by the State Fire Marshal in all state-owned buildings, state-occupied buildings, and state institutions throughout the state. Upon the written request of the chief fire official of any city, county or fire protection district, the State Fire Marshal may authorize such chief fire official and his or her authorized representatives, in their geographical area of responsibility, to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, for the purpose of enforcing the regulations relating to fire and panic safety adopted by the State Fire Marshal pursuant to this section and building standards relating to fire and panic safety published in the California Building Standards Code. Authorization from the State Fire Marshal shall be limited to those fire departments or fire districts which maintain a fire prevention bureau staffed by paid personnel.

Pursuant to Health and Safety Code Section 13108, any requirement or order made by any chief fire official who is authorized by the State Fire Marshal to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, may be appealed to the State Fire Marshal. The State Fire Marshal shall, upon receiving an appeal and subject to the provisions of Chapter 5 (commencing with Section 18945) of Part 2.5 of Division 13 of the Health and Safety Code, determine if the requirement or order made is reasonably consistent with the fire and panic safety regulations adopted by the State Fire Marshal and building standards relating to fire and panic safety published in the California Building Code.

Any person may request a code interpretation from the State Fire Marshal relative to the intent of any regulation or provision adopted by the State Fire Marshal. When the request relates to a specific project, occupancy or building, the State Fire Marshal shall review the issue with the appropriate local enforcing agency prior to rendering such code interpretation.

**1.11.2.1.3** Pursuant to Health and Safety Code Section 13112, any person who violates any order, rule or regulation of the State Fire Marshal is guilty of a misdemeanor punishable by a fine of not less than \$100.00 or more than \$500.00, or by imprisonment for not less than six months, or by both. A person is guilty of a separate offense each day during which he or she commits, continues or permits a violation of any provision of, or any order, rule or regulation of, the State Fire Marshal as contained in this code.

Any inspection authority who, in the exercise of his or her authority as a deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

**1.11.2.2 Right of entry.** The fire chief of any city, county or fire protection district, or such person's authorized representative, may enter any state institution or any other state-owned or state-occupied building for the purpose of preparing a fire suppression preplanning program or for



the purpose of investigating any fire in a state-occupied building.

The State Fire Marshal, his or her deputies or salaried assistants, the chief of any city or county fire department or fire protection district and his or her authorized representatives may enter any building or premises not used for dwelling purposes at any reasonable hour for the purpose of enforcing this chapter. The owner, lessee, manager or operator of any such building or premises shall permit the State Fire Marshal, his or her deputies or salaried assistants and the chief of any city or county fire department or fire protection district and his or her authorized representatives to enter and inspect them at the time and for the purpose stated in this section.

#### **1.11.2.3 More restrictive fire and panic safety building standards.**

**1.11.2.3.1** Any fire protection district organized pursuant to Health and Safety Code Part 2.7 (commencing with Section 13800) of Division 12 may adopt building standards relating to fire and panic safety that are more stringent than those building standards adopted by the State Fire Marshal and contained in the California Building Standards Code. For these purposes, the district board shall be deemed a legislative body and the district shall be deemed a local agency. Any changes or modifications that are more stringent than the requirements published in the California Building Standards Code relating to fire and panic safety shall be subject to Section 1.1.8.1.

**1.11.2.3.2** Any fire protection district that proposes to adopt an ordinance pursuant to this section shall, not less than 30 days prior to noticing a proposed ordinance for public hearing, provide a copy of that ordinance, together with the adopted findings made pursuant to Section 1.11.2.3.1, to the city, county, or city and county where the ordinance will apply. The city, county, or city and county may provide the district with written comments, which shall become part of the fire protection district's public hearing record.

**1.11.2.3.3** The fire protection district shall transmit the adopted ordinance to the city, county, or city and county where the ordinance will apply. The legislative body of the city, county, or city and county may ratify, modify or deny an adopted ordinance and transmit its determination to the district within 15 days of the determination. Any modification or denial of an adopted ordinance shall include a written statement describing the reasons for any modifications or denial. No ordinance adopted by the district shall be effective until ratification by the city, county, or city and county where the ordinance will apply. Upon ratification of an adopted ordinance, the city, county or city and county shall file a copy of the findings of the district, and any findings of the city, county, or city and county, together with the adopted ordinance expressly marked and identified to which each finding refers, in accordance with Section 1.1.8.1(3).

**1.11.2.4 Request for alternate means of protection.** Requests for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance. The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in Title 19, California Code of Regulation, to substantiate the equivalency of the proposed alternative means of protection.

When a request for alternate means of protection involves hazardous materials, the authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) developed in accordance with Title 19, Division 2, Chapter 4.5, Article 3.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

**1.11.2.5 Appeals.** When a request for an alternate means of protection has been denied by the enforcing agency, the applicant may file a written appeal to the State Fire Marshal for consideration of the applicant's proposal. In considering such appeal, the State Fire Marshal may seek the advice of the State Board of Fire Services. The State Fire Marshal shall, after considering all of the facts presented, including any recommendations of the State Board of Fire Services, determine if the proposal is for the purposes intended, at least equivalent to that specified in these regulations in quality, strength, effectiveness, fire resistance, durability and safety, and shall transmit such findings and any recommendations to the applicant and to the enforcing agency.

#### **1.11.3 Construction documents.**

**1.11.3.1 Public schools.** Plans and specifications for the construction, alteration or addition to any building owned, leased or rented by any public school district shall be submitted to the Division of the State Architect.

**1.11.3.2 Movable walls and partitions.** Plans or diagrams shall be submitted to the enforcing agency for approval before the installation of, or rearrangement of, any movable wall or partition in any occupancy. Approval shall be granted only if there is no increase in the fire hazard.

#### **1.11.3.3 New construction high-rise buildings.**

1. Complete plans or specifications, or both, shall be prepared covering all work required to comply with new construction high-rise buildings. Such plans and specifications shall be submitted to the enforcing agency having jurisdiction.

2. All plans and specifications shall be prepared under the responsible charge of an architect or a civil or structural engineer authorized by law to develop construction plans and specifications, or by both such architect and engineer. Plans and specifications shall be prepared by an engineer duly qualified in that branch of engineering necessary to perform such services. Administration of the work of construction shall be under the charge of the responsible architect or engineer except that where plans and specifications involve alterations or repairs, such work of construction may be administered by an engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 65700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications and estimates and work of construction are applicable.

This section shall not be construed as preventing the design of fire-extinguishing systems by persons holding a C-16 license issued pursuant to Division 3, Chapter 9, Business and Professions Code. In such instances, however, the responsibility charge of this section shall prevail.

#### **1.11.3.4 Existing high-rise buildings.**

1. Complete plans or specifications, or both, shall be prepared covering all work required by Section 3412 for existing high-rise buildings. Such plans or specifications shall be submitted to the enforcing agency having jurisdiction.
2. When new construction is required to conform with the provisions of these regulations, complete plans or specifications, or both, shall be prepared in accordance with the provisions of this subsection. As used in this section, "new construction" is not intended to include repairs, replacements or minor alterations which do not disrupt or appreciably add to or affect the structural aspects of the building.

**1.11.3.5 Retention of plans.** Refer to Building Standards Law, Health and Safety Code Sections 19850 and 19851 for permanent retention of plans.

#### **1.11.4 Fees.**

**1.11.4.1 Other fees.** Pursuant to Health and Safety Code Section 13146.2, a city, county or district which inspects a hotel, motel, lodging house or apartment house may charge and collect a fee for the inspection from the owner of the structure in an amount, as determined by the city, county or district, sufficient to pay its costs of that inspection.

**1.11.4.2 Large family day-care.** Pursuant to Health and Safety Code Section 1597.46, Large Family Day-Care Homes, the local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process.

**1.11.4.3 High-Rise.** Pursuant to Health and Safety Code Section 13217, High-Rise Structure Inspection: Fees and costs, a local agency which inspects a high-rise structure

pursuant to Health and Safety Code Section 13217 may charge and collect a fee for the inspection from the owner of the high-rise structure in an amount, as determined by the local agency, sufficient to pay its costs of that inspection.

**1.11.4.4 Fire clearance preinspection.** Pursuant to Health and Safety Code Section 13235, Fire Clearance Preinspection, fee, upon receipt of a request from a prospective licensee of a community care facility, as defined in Section 1502, of a residential care facility for the elderly, as defined in Section 1569.2, or of a child day care facility, as defined in Section 1596.750, the local fire enforcing agency, as defined in Section 13244, or State Fire Marshal, whichever has primary jurisdiction, shall conduct a preinspection of the facility prior to the final fire clearance approval. At the time of the preinspection, the primary fire enforcing agency shall price consultation and interpretation of the fire safety regulations and shall notify the prospective licensee of the facility in writing of the specific fire safety regulations which shall be enforced in order to obtain fire clearance approval. A fee equal to, but not exceeding, the actual cost of the preinspection may be charged for the preinspection of a facility with a capacity to serve 25 or fewer persons. A fee equal to, but not exceeding, the actual cost of the preinspection may be charged for a preinspection of a facility with a capacity to serve 26 or more persons.

**1.11.4.5 Care facilities.** The primary fire enforcing agency shall complete the final fire clearance inspection for a community care facility, residential care facility for the elderly, or child day care facility within 30 days of receipt of the request for the final inspection, or as of the date the prospective facility requests the final prelicensure inspection by the State Department of Social Services, whichever is later.

Pursuant to Health and Safety Code Section 13235, a preinspection fee equal to, but not exceeding, the actual cost of the preinspection may be charged for a facility with a capacity to serve 25 or less clients. A fee equal to, but not exceeding, the actual cost of the preinspection may be charged for a preinspection of a facility with a capacity to serve 26 or more clients.

Pursuant to Health and Safety Code Section 13131.5, a reasonable final inspection fee, not to exceed the actual cost of inspection services necessary to complete a final inspection may be charged for occupancies classified as residential care facilities for the elderly (RCFE).

Pursuant to Health and Safety Code Section 1569.84, neither the State Fire Marshal nor any local public entity shall charge any fee for enforcing fire inspection regulations pursuant to state law or regulation or local ordinance, with respect to residential care facilities for the elderly (RCFE) which service six or fewer persons.

**1.11.4.6 Requests of the Office of the State Fire Marshal.** Whenever a local authority having jurisdiction requests that the State Fire Marshal perform plan review and/or inspection services related to a building permit, the appli-

*cable fees for such shall be payable to the Office of the State Fire Marshal.*

**1.11.5 Inspections.** *Work performed subject to the provisions of this code shall comply with the inspection requirements of Sections 109.1, 109.3, 109.3.4, 109.3.5, 109.3.6, 109.3.8, 109.3.9, 109.3.10 109.5 and 109.6 as adopted by the Office of the State Fire Marshal.*

**1.11.5.1 Existing Group I -1 or R occupancies.** *Licensed 24-hour care in a Group I-1 or R occupancy in existence and originally classified under previously adopted state codes shall be reinspected under the appropriate previous code, provided there is no change in the use or character which would place the facility in a different occupancy group.*

**1.11.6 Certificate of Occupancy.** *A Certificate of Occupancy shall be issued as specified in Section 111.*

**Exception:** *Group R, Division 3 and Group U occupancies.*

**|| 1.11.7 Temporary structures and uses.** *See Section 108.*

**1.11.8 Service utilities.** *See Section 112.*

**1.11.9 Stop work order.** *See Section 115.*

**1.11.10 Unsafe buildings, structures and equipment.** *See Section 116.*

## SECTION 1.12 STATE LIBRARIAN

**1.12.1** Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application**—Public library construction and renovation using funds from the California Library Construction and Renovation Bond Act of 1988.

**Enforcing agency**—State librarian.

**Authority cited**—Education Code Sections 19950 through 19981.

**Reference**—Education Code Sections 19950 through 19981.

## SECTION 1.13 Reserved

## SECTION 1.14 CALIFORNIA STATE LANDS COMMISSION

**1.14.1** Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

**Application**—Marine oil terminals.

**Enforcing agency**—California State Lands Commission.

**Authority cited**—Public Resources Code Section 8755.

**Reference**—Public Resources Code Section 8755.



## DIVISION II

# SCOPE AND ADMINISTRATION

**Note:** Sections adopted or amended by state agencies are specifically indicated by an agency banner or indicated in the Matrix Adoption Table.

## PART 1—SCOPE AND APPLICATION

### SECTION 101 GENERAL

[A] **101.1 Title.** These regulations shall be known as the Building Code of [NAME OF JURISDICTION], hereinafter referred to as “this code.”

[A] **101.2 Scope.** The provisions of this code shall apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

**Exception:** Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *California Residential Code*.

[A] **101.2.1 Appendices.** Provisions in the appendices shall not apply unless specifically adopted.

[A] **101.3 Intent.** The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

[A] **101.4 Referenced codes.** The other codes listed in Sections 101.4.1 through 101.4.6 and referenced elsewhere in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference.

[A] **101.4.1 Gas.** The provisions of the *California Mechanical Code* shall apply to the installation of gas piping from the point of delivery, gas appliances and related accessories as covered in this code. These requirements apply to gas piping systems extending from the point of delivery to the inlet connections of appliances and the installation and operation of residential and commercial gas appliances and related accessories.

[A] **101.4.2 Mechanical.** The provisions of the *California Mechanical Code* shall apply to the installation, alterations, repairs and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and/or appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

[A] **101.4.3 Plumbing.** The provisions of the *California Plumbing Code* shall apply to the installation, alteration, repair and replacement of plumbing systems, including equipment, appliances, fixtures, fittings and appurtenances, and where connected to a water or sewage system and all aspects of a medical gas system. The provisions of the *International Private Sewage Disposal Code* shall apply to private sewage disposal systems.

[A] **101.4.4 Property maintenance.** The provisions of the *California Property Maintenance Code* shall apply to existing structures and premises; equipment and facilities; light, ventilation, space heating, sanitation, life and fire safety hazards; responsibilities of owners, operators and occupants; and occupancy of existing premises and structures.

[A] **101.4.5 Fire prevention.** The provisions of the *California Fire Code* shall apply to matters affecting or relating to structures, processes and premises from the hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices; from conditions hazardous to life, property or public welfare in the occupancy of structures or premises; and from the construction, extension, repair, alteration or removal of fire suppression, automatic sprinkler systems and alarm systems or fire hazards in the structure or on the premises from occupancy or operation.

[A] **101.4.6 Energy.** The provisions of the *California Energy Code* shall apply to all matters governing the design and construction of buildings for energy efficiency.

**Exception:** [OSHPD 1, 2, & 4] Not required by OSHPD.

### SECTION 102 APPLICABILITY

[A] **102.1 General.** Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[A] **102.2 Other laws.** The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

[A] **102.3 Application of references.** References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

**[A] 102.4 Referenced codes and standards.** The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections 102.4.1 through 102.4.4.

**[A] 102.4.1 Conflicts.** Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

**[A] 102.4.2 Provisions in referenced codes and standards.** Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code or the California Codes listed in Section 101.4, the provisions of this code or the California Codes listed in Section 101.4, as applicable, shall take precedence over the provisions in the referenced code or standard.

**102.4.3 Code References.** *[OSHPD 1, 2, 3 & 4, DSA-SS & DSA-SS/CC] All reference to International Codes or other similar codes in referenced standards shall be replaced by equivalent provisions in the California Building Standards Codes.*

**102.4.4 Reference in Standards.** *[OSHPD 1, 2, 3 & 4, DSA-SS & DSA-SS/CC] All references listed in reference standards shall be replaced by referenced standards listed in Chapter 35 of this code, where applicable, and shall include all amendments to the reference standards in this code.*

**[A] 102.5 Partial invalidity.** In the event that any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

**[A] 102.6 Existing structures.** The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the *California Building Code* or the *California Fire Code*, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.

## PART 2—ADMINISTRATION AND ENFORCEMENT

### SECTION 103 DEPARTMENT OF BUILDING SAFETY

**[A] 103.1 Creation of enforcement agency.** The Department of Building Safety is hereby created and the official in charge thereof shall be known as the building official.

**[A] 103.2 Appointment.** The building official shall be appointed by the chief appointing authority of the jurisdiction.

**[A] 103.3 Deputies.** In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the building official shall have the authority to appoint a deputy building official, the related technical officers, inspectors, plan examiners and other employees. Such employees shall have powers as delegated

by the building official. For the maintenance of existing properties, see the *California Property Maintenance Code*.

### SECTION 104 DUTIES AND POWERS OF BUILDING OFFICIAL

**[A] 104.1 General.** The building official is hereby authorized and directed to enforce the provisions of this code. The building official shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.

**[A] 104.2 Applications and permits.** The building official shall receive applications, review construction documents and issue permits for the erection, and alteration, demolition and moving of buildings and structures, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

**[A] 104.3 Notices and orders.** The building official shall issue all necessary notices or orders to ensure compliance with this code.

**[A] 104.4 Inspections.** The building official shall make all of the required inspections, or the building official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.

**[A] 104.5 Identification.** The building official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.

**[A] 104.6 Right of entry.** Where it is necessary to make an inspection to enforce the provisions of this code, or where the building official has reasonable cause to believe that there exists in a structure or upon a premises a condition which is contrary to or in violation of this code which makes the structure or premises unsafe, dangerous or hazardous, the building official is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested. If such structure or premises is unoccupied, the building official shall first make a reasonable effort to locate the owner or other person having charge or control of the structure or premises and request entry. If entry is refused, the building official shall have recourse to the remedies provided by law to secure entry.

**[A] 104.7 Department records.** The building official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for retention of public records.

**[A] 104.8 Liability.** The building official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties. Any suit instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representative of the jurisdiction until the final termination of the proceedings. The building official or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

**[A] 104.9 Approved materials and equipment.** Materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

**[A] 104.9.1 Used materials and equipment.** The use of used materials which meet the requirements of this code for new materials is permitted. Used equipment and devices shall not be reused unless approved by the building official.

**[A] 104.10 Modifications.** Wherever there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative, provided the building official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, accessibility, life and fire safety, or structural requirements. The details of action granting modifications shall be recorded and entered in the files of the department of building safety.

**[A] 104.10.1 Flood hazard areas.** The building official shall not grant modifications to any provision required in flood hazard areas as established by Section 1612.3 unless a determination has been made that:

1. A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section 1612 inappropriate.
2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.
4. A determination that the variance is the minimum necessary to afford relief, considering the flood hazard.

5. Submission to the applicant of written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the design flood elevation increases risks to life and property.

**[A] 104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. *[DSA-SS & DSA-SS/CC, OSHPD 1, 2 & 4] Alternative system shall satisfy ASCE 7 Section 1.3, unless more restrictive requirements are established by this code for an equivalent system.*

*[DSA-SS & DSA-SS/CC, OSHPD 1, 2 & 4] Alternative systems also satisfy the California Administrative Code, Section 7-104.*

**[A] 104.11.1 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**[A] 104.11.2 Tests.** Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

**104.11.3 Peer review.** *[OSHPD 1 & 4] When peer review is required, it shall be performed pursuant to Section 3414A.*

**104.11.4 Earthquake monitoring instruments.** *[OSHPD 1 & 4] The enforcement agency may require earthquake monitoring instruments for any building that receives approval of an alternative system for the Lateral Force Resisting System (LFRS). There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent. A proposal for instrumentation and equipment specifications*



shall be forwarded to the enforcement agency for review and approval.

The instruments shall be interconnected for common start and common timing. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating "MAIN-TAIN CLEAR ACCESS TO THIS INSTRUMENT" shall be posted in a conspicuous location.

The Owner of the building shall be responsible for the implementation of the instrumentation program. Maintenance of the instrumentation and removal/processing of the records shall be the responsibility of the enforcement agency or its designated agent.

## SECTION 105 PERMITS

**[A] 105.1 Required.** Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first make application to the building official and obtain the required permit.

**[A] 105.1.1 Annual permit.** In lieu of an individual permit for each alteration to an already approved electrical, gas, mechanical or plumbing installation, the building official is authorized to issue an annual permit upon application therefor to any person, firm or corporation regularly employing one or more qualified tradepersons in the building, structure or on the premises owned or operated by the applicant for the permit.

**[A] 105.1.2 Annual permit records.** The person to whom an annual permit is issued shall keep a detailed record of alterations made under such annual permit. The building official shall have access to such records at all times or such records shall be filed with the building official as designated.

**[A] 105.2 Work exempt from permit.** Exemptions from permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Permits shall not be required for the following:

### Building:

1. One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided the floor area is not greater than 120 square feet (11 m<sup>2</sup>).
2. Fences not over 7 feet (2134 mm) high.
3. Oil derricks.
4. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or IIIA liquids.

5. Water tanks supported directly on grade if the capacity is not greater than 5,000 gallons (18 925 L) and the ratio of height to diameter or width is not greater than 2:1.
6. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade, and not over any basement or story below and are not part of an accessible route.
7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
8. Temporary motion picture, television and theater stage sets and scenery.
9. Prefabricated swimming pools accessory to a Group R-3 occupancy that are less than 24 inches (610 mm) deep, are not greater than 5,000 gallons (18 925 L) and are installed entirely above ground.
10. Shade cloth structures constructed for nursery or agricultural purposes, not including service systems.
11. Swings and other playground equipment accessory to detached one- and two-family dwellings.
12. Window awnings in Group R-3 and U occupancies, supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

### Electrical:

**Repairs and maintenance:** Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.

**Radio and television transmitting stations:** The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for a power supply and the installations of towers and antennas.

**Temporary testing systems:** A permit shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.

### Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

### Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.

5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (5 kg) or less of refrigerant and actuated by motors of 1 horsepower (746 W) or less.

#### Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe, provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

**[A] 105.2.1 Emergency repairs.** Where equipment replacements and repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day to the building official.

**[A] 105.2.2 Repairs.** Application or notice to the building official is not required for ordinary repairs to structures, replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles. Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.

**[A] 105.2.3 Public service agencies.** A permit shall not be required for the installation, alteration or repair of generation, transmission, distribution or metering or other related equipment that is under the ownership and control of public service agencies by established right.

**[A] 105.3 Application for permit.** To obtain a permit, the applicant shall first file an application therefor in writing on a form furnished by the department of building safety for that purpose. Such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.

3. Indicate the use and occupancy for which the proposed work is intended.
4. Be accompanied by construction documents and other information as required in Section 107.
5. State the valuation of the proposed work.
6. Be signed by the applicant, or the applicant's authorized agent.
7. Give such other data and information as required by the building official.

**[A] 105.3.1 Action on application.** The building official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing, stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefor as soon as practicable.

**[A] 105.3.2 Time limitation of application.** An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing, unless such application has been pursued in good faith or a permit has been issued; except that the building official is authorized to grant one or more extensions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated. *[OSHPD 1, 2, & 4] Time limitation shall be in accordance with the California Administrative Code, Chapter 7, Section 7-129.*

**[A] 105.4 Validity of permit.** The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction of errors in the construction documents and other data. The building official is also authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this jurisdiction.

**[A] 105.5 Expiration.** Every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 180 days after its issuance, or if the work authorized on the site by such permit is suspended or abandoned for a period of 180 days after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.

**[A] 105.6 Suspension or revocation.** The building official is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete informa-

tion, or in violation of any ordinance or regulation or any of the provisions of this code.

**[A] 105.7 Placement of permit.** The building permit or copy shall be kept on the site of the work until the completion of the project.

## SECTION 106 FLOOR AND ROOF DESIGN LOADS

**[A] 106.1 Live loads posted.** Where the live loads for which each floor or portion thereof of a commercial or industrial building is or has been designed to exceed 50 psf (2.40 kN/m<sup>2</sup>), such design live loads shall be conspicuously posted by the owner in that part of each story in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.

**106.1.1 Snow Load Posting.** *[DSA-SS & DSA-SS/CC, OSHPD 1, 2, & 4] Snow loads used in design shall be posted as for live loads.*

**106.1.2 Load Posting Responsibility.** *[OSHPD 1, 2, & 4] The owner or governing board shall be responsible for keeping the actual load below the allowable limits.*

**[A] 106.2 Issuance of certificate of occupancy.** A certificate of occupancy required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.

**[A] 106.3 Restrictions on loading.** It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.

## SECTION 107 SUBMITTAL DOCUMENTS

**[A] 107.1 General.** Submittal documents consisting of construction documents, statement of special inspections, geotechnical report and other data shall be submitted in two or more sets with each permit application. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

**Exception:** The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

**[A] 107.2 Construction documents.** Construction documents shall be in accordance with Sections 107.2.1 through 107.2.5.

**[A] 107.2.1 Information on construction documents.** Construction documents shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building

official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.

**[A] 107.2.2 Fire protection system shop drawings.** Shop drawings for the fire protection system(s) shall be submitted to indicate conformance to this code and the construction documents and shall be approved prior to the start of system installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.

**[A] 107.2.3 Means of egress.** The construction documents shall show in sufficient detail the location, construction, size and character of all portions of the means of egress including the path of the exit discharge to the public way in compliance with the provisions of this code. In other than occupancies in Groups R-2, R-3, and I-1, the construction documents shall designate the number of occupants to be accommodated on every floor, and in all rooms and spaces.

**[A] 107.2.4 Exterior wall envelope.** Construction documents for all buildings shall describe the exterior wall envelope in sufficient detail to determine compliance with this code. The construction documents shall provide details of the exterior wall envelope as required, including flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive membrane and details around openings.

The construction documents shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system which was tested, where applicable, as well as the test procedure used.

**[A] 107.2.5 Site plan.** The construction documents submitted with the application for permit shall be accompanied by a site plan showing to scale the size and location of new construction and existing structures on the site, distances from lot lines, the established street grades and the proposed finished grades and, as applicable, flood hazard areas, floodways, and design flood elevations; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The building official is authorized to waive or modify the requirement for a site plan when the application for permit is for alteration or repair or when otherwise warranted.

**[A] 107.2.5.1 Design flood elevations.** Where design flood elevations are not specified, they shall be established in accordance with Section 1612.3.1.

**[A] 107.3 Examination of documents.** The building official shall examine or cause to be examined the accompanying submittal documents and shall ascertain by such examinations whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

**[A] 107.3.1 Approval of construction documents.** When the building official issues a permit, the construction documents shall be approved, in writing or by stamp, as "Reviewed for Code Compliance." One set of construction documents so reviewed shall be retained by the building official. The other set shall be returned to the applicant, shall be kept at the site of work and shall be open to inspection by the building official or a duly authorized representative.

**[A] 107.3.2 Previous approvals.** This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

**[A] 107.3.3 Phased approval.** The building official is authorized to issue a permit for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such permit for the foundation or other parts of a building or structure shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire structure will be granted.

**[A] 107.3.4 Design professional in responsible charge.** When it is required that documents be prepared by a registered design professional, the building official shall be authorized to require the owner to engage and designate on the building permit application a registered design professional who shall act as the registered design professional in responsible charge. If the circumstances require, the owner shall designate a substitute registered design professional in responsible charge who shall perform the duties required of the original registered design professional in responsible charge. The building official shall be notified in writing by the owner if the registered design professional in responsible charge is changed or is unable to continue to perform the duties.

The registered design professional in responsible charge shall be responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building.

**[A] 107.3.4.1 Deferred submittals.** For the purposes of this section, deferred submittals are defined as those portions of the design that are not submitted at the time

of the application and that are to be submitted to the building official within a specified period.

Deferral of any submittal items shall have the prior approval of the building official. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by the building official.

Documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by the building official. *[OSHPD 1, 2, & 4] Deferred submittals shall be in accordance with the California Administrative Code, Chapter 7, Section 7-126.*

**[A] 107.4 Amended construction documents.** Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

**[A] 107.5 Retention of construction documents.** One set of approved construction documents shall be retained by the building official for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.

## SECTION 108 TEMPORARY STRUCTURES AND USES

**[A] 108.1 General.** The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

**[A] 108.2 Conformance.** Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

**[A] 108.3 Temporary power.** The building official is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in NFPA 70.

**[A] 108.4 Termination of approval.** The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

## SECTION 109 FEES

**[A] 109.1 Payment of fees.** A permit shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

**[A] 109.2 Schedule of permit fees.** On buildings, structures, electrical, gas, mechanical, and plumbing systems or alterations requiring a permit, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

**[A] 109.3 Building permit valuations.** The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor, for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the building official, the valuation is underestimated on the application, the permit shall be denied, unless the applicant can show detailed estimates to meet the approval of the building official. Final building permit valuation shall be set by the building official.

**[A] 109.4 Work commencing before permit issuance.** Any person who commences any work on a building, structure, electrical, gas, mechanical or plumbing system before obtaining the necessary permits shall be subject to a fee established by the building official that shall be in addition to the required permit fees.

**[A] 109.5 Related fees.** The payment of the fee for the construction, alteration, removal or demolition for work done in connection to or concurrently with the work authorized by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

**[A] 109.6 Refunds.** The building official is authorized to establish a refund policy.

## SECTION 110 INSPECTIONS

**[A] 110.1 General.** Construction or work for which a *permit* is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the building official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

**[A] 110.2 Preliminary inspection.** Before issuing a permit, the building official is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.

**[A] 110.3 Required inspections.** The building official, upon notification, shall make the inspections set forth in Sections 110.3.1 through 110.3.10.

**[A] 110.3.1 Footing and foundation inspection.** Footing and foundation inspections shall be made after excavations for footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job, except where concrete is ready mixed in accordance with ASTM C 94, the concrete need not be on the job.

**[A] 110.3.2 Concrete slab and under-floor inspection.** Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduit, piping accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the subfloor.

**[A] 110.3.3 Lowest floor elevation.** In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.5 shall be submitted to the building official.

**[A] 110.3.4 Frame inspection.** Framing inspections shall be made after the roof deck or sheathing, all framing, fire-blocking and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved.

**110.3.4.1 (HCD 1) Moisture content verification.** *Moisture content of framing members shall be verified in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

**[A] 110.3.5 Lath and gypsum board inspection.** Lath and gypsum board inspections shall be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or gypsum board joints and fasteners are taped and finished.

**Exception:** Gypsum board that is not part of a fire-resistance-rated assembly or a shear assembly.

**[A] 110.3.6 Fire- and smoke-resistant penetrations.** Protection of joints and penetrations in fire-resistance-rated assemblies, smoke barriers and smoke partitions shall not be concealed from view until inspected and approved.

**[A] 110.3.7 Energy efficiency inspections.** Inspections shall be made to determine compliance with Chapter 13 and shall include, but not be limited to, inspections for: envelope insulation R- and U-values, fenestration U-value, duct system R-value, and HVAC and water-heating equipment efficiency.

**[A] 110.3.8 Other inspections.** In addition to the inspections specified in Sections 110.3.1 through 110.3.7, the building official is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by the department of building safety.

[A] **110.3.9 Special inspections.** For special inspections, see Chapter 17.

[A] **110.3.10 Final inspection.** The final inspection shall be made after all work required by the building permit is completed.

[A] **110.3.10.1 Flood hazard documentation.** If located in a flood hazard area, documentation of the elevation of the lowest floor as required in Section 1612.5 shall be submitted to the building official prior to the final inspection.

**110.3.10.2 (HCD 1) Operation and maintenance manual.** At the time of final inspection, a manual, compact disc, web-based reference or other media acceptable to the enforcing agency shall be placed in the building in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.4.

[A] **110.4 Inspection agencies.** The building official is authorized to accept reports of approved inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

[A] **110.5 Inspection requests.** It shall be the duty of the holder of the building permit or their duly authorized agent to notify the building official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

[A] **110.6 Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

## SECTION 111 CERTIFICATE OF OCCUPANCY

[A] **111.1 Use and occupancy.** No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made, until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction.

**Exception:** Certificates of occupancy are not required for work exempt from permits under Section 105.2.

[A] **111.2 Certificate issued.** After the building official inspects the building or structure and finds no violations of the provisions of this code or other laws that are enforced by the department of building safety, the building official shall issue a certificate of occupancy that contains the following:

1. The building permit number.
2. The address of the structure.

3. The name and address of the owner.
4. A description of that portion of the structure for which the certificate is issued.
5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code for the occupancy and division of occupancy and the use for which the proposed occupancy is classified.
6. The name of the building official.
7. The edition of the code under which the permit was issued.
8. The use and occupancy, in accordance with the provisions of Chapter 3.
9. The type of construction as defined in Chapter 6.
10. The design occupant load.
11. If an automatic sprinkler system is provided, whether the sprinkler system is required.
12. Any special stipulations and conditions of the building permit.

[A] **111.3 Temporary occupancy.** The building official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The building official shall set a time period during which the temporary certificate of occupancy is valid.

[A] **111.4 Revocation.** The building official is authorized to, in writing, suspend or revoke a certificate of occupancy or completion issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.

## SECTION 112 SERVICE UTILITIES

[A] **112.1 Connection of service utilities.** No person shall make connections from a utility, source of energy, fuel or power to any building or system that is regulated by this code for which a permit is required, until released by the building official.

[A] **112.2 Temporary connection.** The building official shall have the authority to authorize the temporary connection of the building or system to the utility source of energy, fuel or power.

[A] **112.3 Authority to disconnect service utilities.** The building official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards set forth in Section 101.4 in case of emergency where necessary to eliminate an immediate hazard to life or property or when such utility connection has been made without the approval required by Section 112.1 or 112.2. The building official shall notify the serving utility, and wherever possible the owner and occupant of the building, structure or service

system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

### SECTION 113 BOARD OF APPEALS

**[A] 113.1 General.** In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business.

**[A] 113.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The board shall have no authority to waive requirements of this code.

**[A] 113.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

### SECTION 114 VIOLATIONS

**[A] 114.1 Unlawful acts.** It shall be unlawful for any person, firm or corporation to erect, construct, alter, extend, repair, move, remove, demolish or occupy any building, structure or equipment regulated by this code, or cause same to be done, in conflict with or in violation of any of the provisions of this code.

**[A] 114.2 Notice of violation.** The building official is authorized to serve a notice of violation or order on the person responsible for the erection, construction, alteration, extension, repair, moving, removal, demolition or occupancy of a building or structure in violation of the provisions of this code, or in violation of a permit or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

**[A] 114.3 Prosecution of violation.** If the notice of violation is not complied with promptly, the building official is authorized to request the legal counsel of the jurisdiction to institute the appropriate proceeding at law or in equity to restrain, correct or abate such violation, or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of this code or of the order or direction made pursuant thereto.

**[A] 114.4 Violation penalties.** Any person who violates a provision of this code or fails to comply with any of the requirements thereof or who erects, constructs, alters or repairs a building or structure in violation of the approved construction documents or directive of the building official,

or of a permit or certificate issued under the provisions of this code, shall be subject to penalties as prescribed by law.

### SECTION 115 STOP WORK ORDER

**[A] 115.1 Authority.** Whenever the building official finds any work regulated by this code being performed in a manner either contrary to the provisions of this code or dangerous or unsafe, the building official is authorized to issue a stop work order.

**[A] 115.2 Issuance.** The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

**[A] 115.3 Unlawful continuance.** Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

### SECTION 116 UNSAFE STRUCTURES AND EQUIPMENT

**[A] 116.1 Conditions.** Structures or existing equipment that are or hereafter become unsafe, insanitary or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or which constitute a fire hazard, or are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe structures shall be taken down and removed or made safe, as the building official deems necessary and as provided for in this section. A vacant structure that is not secured against entry shall be deemed unsafe.

**[A] 116.2 Record.** The building official shall cause a report to be filed on an unsafe condition. The report shall state the occupancy of the structure and the nature of the unsafe condition.

**[A] 116.3 Notice.** If an unsafe condition is found, the building official shall serve on the owner, agent or person in control of the structure, a written notice that describes the condition deemed unsafe and specifies the required repairs or improvements to be made to abate the unsafe condition, or that requires the unsafe structure to be demolished within a stipulated time. Such notice shall require the person thus notified to declare immediately to the building official acceptance or rejection of the terms of the order.

**[A] 116.4 Method of service.** Such notice shall be deemed properly served if a copy thereof is (a) delivered to the owner personally; (b) sent by certified or registered mail addressed to the owner at the last known address with the return receipt requested; or (c) delivered in any other manner as prescribed by local law. If the certified or registered letter is returned showing that the letter was not delivered, a copy thereof shall



be posted in a conspicuous place in or about the structure affected by such notice. Service of such notice in the foregoing manner upon the owner's agent or upon the person responsible for the structure shall constitute service of notice upon the owner.

**[A] 116.5 Restoration.** The structure or equipment determined to be unsafe by the building official is permitted to be restored to a safe condition. To the extent that repairs, alterations or additions are made or a change of occupancy occurs during the restoration of the structure, such repairs, alterations, additions or change of occupancy shall comply with the requirements of Section 105.2.2 and Chapter 34.



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 2 – DEFINITIONS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
201.3		X																		
201.4		X																		
202		X	X	X	X															
Access Aisle						X														
Accessibility			X	X	X	X														
Accessible			X	X	X	X														
Accessible Element						X														
Accessible Means of Egress						X														
Accessible Route			X	X	X	X														
Accessible Space						X														
> Active Equipment/Component							X	X	X	X	X	X								
Adaptable						X														
Adaptable Dwelling Unit			X	X	X															
Addition (2nd paragraph only)						X														
Administrative Authority						X														
Aged Home or Institution		X																		
Aisle (2nd paragraph only)						X														
> Alteration						X														
Alternative System									X			X								
Amusement Attraction						X														
Amusement Ride						X														
Amusement Ride Seat						X														
Ancillary Facility													X							
ANSI						X														
Approved (with notes)			X	X	X															
Approved (2nd paragraph only) (w/o notes)						X														
Approved Agency			X	X																
Approved Listing Agency			X	X	X															
Approved Testing Agency			X	X	X	X														
Area of Refuge						X														
Area of Sport Activity						X														
Assembly Area						X														
Assistive Device			X	X	X															
Assistive Listening System (ALS)						X														
Associated Structural Alterations									X			X								
At-Grade Station		X																		
Automatic Door			X	X	X	X														
Automatic Teller Machine (ATM)						X														

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
<i>Backwash</i>														X						
Bathroom			X	X	X	X														
Bedridden Person		X																		
<i>Blended Transition</i>						X														
<i>Boarding Pier</i>						X														
<i>Boat Launch Ramp</i>						X														
<i>Boat Slip</i>						X														
Building		X																		
Building (with exception)			X	X	X															
Building (w/o notes)						X														
Building Entrance on an Accessible Route			X	X	X															
Building, Existing			X	X	X															
Building Official						X														
<i>Cantilevered Decking</i>														X						
Care and Supervision		X																		
<i>Carriage Unit</i>			X			X														
Catastrophically Injured		X																		
<i>Catch Pool</i>						X														
CCR						X														
<i>CDF Director</i>		X																		
<i>Cell [SFM]</i>		X																		
<i>Cell Complex</i>		X																		
<i>Cell Tiers</i>		X																		
Cellular Concrete			X	X	X															
<i>Central Control Building</i>		X																		
<i>Characters</i>			X	X	X	X														
<i>Charter School</i>		X																		
<i>Child-Care Center</i>		X																		
<i>Child-Care Facilities</i>		X																		
<i>Child or Children</i>		X																		
<i>Children's Use</i>						X														
<i>Chronically Ill</i>		X																		
<i>Circulation Path</i>						X														
<i>Clean Pool Water</i>														X						
<i>Clear</i>						X														
<i>Clear Pool Water</i>														X						
<i>Clear Floor Space</i>						X														
<i>Clinic, Outpatient</i>		X																		

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
Closed-Circuit Telephone						X														
Commercial Facilities						X														
<i>Common Use</i>			†	†		X														
Common Use Areas			X	X	X															
<i>Community Care Facility</i>		X																		
Comply With						X														
Concrete, Cellular			X	X	X															
Congregate Living Health Facility (CLHF)		X																		
Congregate Residence		X																		
<i>Coping</i>														X						
<i>Corrosion Resistant</i>														X						
<i>Courtroom Dock</i>		X																		
<i>Courthouse Holding Facility [SFM]</i>		X																		
Covered Multifamily Dwellings			X	X	X															
Cross Slope			X	X	X	X														
Curb Cut			X	X	X	X														
Curb Ramp			X	X	X	X														
<i>Dangerous</i>		X																		
Day-Care		X																		
<i>Day-Care Home, Family</i>		X																		
Day-Care Home, Large Family		X																		
Day-Care Home, Small Family		X																		
<i>Day Room</i>		X																		
<i>Deck</i>														X						
Department			X	X	X															
Detached Single-Family Dwelling			X	X	X															
Detectable Warning			X	X	X	X														
<i>Detention Elevator [SFM]</i>		X																		
<i>Detention Treatment Room [SFM]</i>		X																		
<i>Detoxification Facilities</i>		X																		
<i>Diaphragm, Rigid</i>							X	X	X			X								
<i>Diatomaceous Earth</i>														X						
<i>Direct Access</i>		X																		
Directional Sign			X	X	X	X														
Disability						X														
Dormitory		X				X														
<i>Dormitory [SFM]</i>		X																		
Dwelling Unit			X	X	X															
<i>Easily Cleanable</i>														X						
<i>Effective Particle Size</i>														X						
<i>Efficiency Dwelling Unit</i>			X	X	X															
<i>Electric Vehicle</i>		X																		
<i>Element</i>						X														

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
<i>Elevated Play Component</i>						X														
<i>Elevated Station</i>		X																		
Elevator, Passenger			X	X	X	X														
<i>Emergency Management Panel (EMP)</i>		X																		
<i>Employee Work Area</i>						X														
<i>Enclosed Station</i>		X																		
Enforcement			X	X	X															
<i>Enforcement Agent</i>							X	X	X			X								
<i>Enforcing Agency</i>		X	X	X	X	X			X	X	X	X		X						
<i>Engineering Analysis (Fire Hazard/ Fire Risk Assessment)</i>		X																		
<i>Entrance</i>					X	X														
<i>Equipment Area</i>		X												X						
<i>Equivalent Facilitation</i>			X	X	X	X														
<i>Existing Building</i>			X	X	X															
<i>Existing Building or Facility</i>						X														
<i>Existing Structure</i>		X								X	X									
<i>Exit</i>						X														
<i>Exterior Covering</i>		X																		
Facility			X	X	X	X														
Family			X	X	X															
<i>Fire Appliance [SFM]</i>		X																		
<i>Fire Hazard Severity Zones</i>		X																		
<i>Fire Protection Plan</i>		X																		
Fire-Retardant Treated Wood [SFM]		X																		
<i>Fire-Smoke Barrier [SFM]</i>		X																		
<i>Fixed Guideway Transit System</i>		X																		
<i>Foster Family Home</i>		X																		
<i>Full-Time Care</i>		X																		
<i>Functional Area</i>						X														
<i>Gangway</i>						X														
<i>General Acute Care Hospital</i>									X			X								
<i>Golf Car Passage</i>						X														
Grab Bar			X	X	X	X														
Grade (Adjacent Ground Elevation)			X	X	X	X														
<i>Grade Break</i>						X														
Ground Floor			X	X	X	X														
<i>Ground Level Play Component</i>						X														
<i>Guard (or Guardrail)</i>			X	X	X	X														
<i>Guideway</i>		X																		
<i>Handhold</i>														X						
Handrail			X	X	X	X														
Hazardous Substance [SFM]		X																		
Health Care Provider						X														

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
<i>Heavy Timber</i>		X																		
High-Rise Building		X																		
<i>High-Rise Building Access</i>		X																		
Historic Buildings						X														
<i>Holding Facility</i>		X																		
<i>Hotel or Motel</i>			X	X	X															
<i>Housing at a Place of Education</i>					X	X														
Housing Unit		X																		
<i>If, If... Then</i>						X														
<i>Ignition-Resistant Material</i>		X																		
<i>Incidental Structural Alterations, Additions or Repairs</i>									X			X								
<i>Infant</i>		X																		
<i>Intended to be occupied as a Resident</i>			†	†	†															
<i>Inlet</i>														X						
International Symbol of Accessibility					X	X														
<i>Key Station</i>						X														
<i>Kick Plate</i>			X	X	X	X														
<i>Kitchen or Kitchenette</i>						X														
<i>Labeled</i>			X	X	X															
<i>Laboratory [SFM]</i>		X																		
<i>Laboratory Suite [SFM]</i>		X																		
<i>Ladder</i>														X						
<i>Lavatory</i>					X	X														
<i>Level Area</i>			X	X	X															
<i>Lift., Platform (Wheelchair)</i>			X	X	X															
<i>Liquid Tight Floor [SFM]</i>		X																		
<i>Listed</i>		X	X	X	X															
<i>Listing Agency</i>			X	X	X															
<i>Living Unit</i>														X						
<i>Local Agency Very High Fire Hazard Severity Zone</i>		X																		
<i>Lobby [SFM]</i>		X	X	X	X															
<i>Lodging House</i>			X	X	X															
<i>Log Wall Construction</i>		X																		
<i>Mail Boxes</i>						X														
<i>Main Drain</i>														X						
<i>Major Structural Alterations, Additions or Repairs</i>									X			X								
Marked Crossing			X	X	X	X														
May						X														
<i>Medical Pool</i>														X						
Mentally Disabled Persons, Profoundly or Severely		X																		

(continued)



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
<i>Mezzanine</i>						X														
<i>Minor Structural Alteration, Additions or Repairs</i>									X			X								
> Motel			X	X																
Motion Picture and Television Pro- duction Studio Sound Stage, Approved Production Facilities and Production Locations		X																		
> Multistory Dwelling Unit			X	X	X															
<i>Naturally Durable Wood</i>																				
> <i>New High-Rise Building</i>		X																		
> Newly Constructed			X	X	X															
<i>Next Generation Attenuation (NGA)</i>							X	X	X			X								
<i>NFPA</i>						X														
<i>Nonambulatory Persons</i>		X																		
<i>Noncombustible [SFM]</i>		X																		
<i>Nonstructural Alteration</i>									X			X								
Normal			X	X	X															
Nosing						X														
<i>NPC 1, NPC 2, NPC 3/NPC 3R, NPC 4 and NPC 5</i>									X			X								
<i>Occupant Load</i>						X														
<i>Occupiable Space</i>						X														
Open Riser			X	X	X	X														
<i>Open Station</i>		X																		
Operable Part					X	X														
<i>Operations Control Center (OCC) (Central Control)</i>		X																		
Organized Camps		X																		
<i>Outlet</i>														X						
Passage Door			X	X	X															
Passenger Elevator			X	X	X	X														
Passive Solar Energy Collector			X	X	X															
Path of Travel						X														
<i>Patio Cover</i>		X																		
> Pedestrian			X	X	X	X														
Pedestrian Ramp																				
Pedestrian Way			X	X	X	X														
<i>Peer Review</i>									X			X								
<i>Performance Standard</i>														X						
<i>Perimeter Overflow System</i>														X						
Permanent						X														
Permanent Portable Building [SFM]		X																		
<i>Permissible Exposure Limit</i>														X						
Permit						X														
Persons with Disabilities			X	X	X															

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
Pictogram					X	X														
Place of Public Accommodation					X	X														
Platform						X														
Platform (Wheelchair) Lift			X	X	X	X														
Play Area						X														
Play Component						X														
Point of Safety		X																		
Pool or Public Pool														X						
Pool Operator or Operator														X						
Pool User														X						
Point-of-Sale Device						X														
Powder Room			X	X	X	X														
Power-Assisted Door						X														
Power Substation		X																		
Primary Entry			X	X	X															
Primary-Entry Level			X	X	X															
Primary Function		X																		
Private Building or Facility						X														
Professional Office of a Health Care Provider						X														
Protective Social Care Facility [SFM]		X																		
Public Accommodation																				
Public Building or Facility						X														
Public Entity					X	X														
Public Entrance			X	X	X	X														
Public Housing					X	X														
Public Use						X														
Public-Use Areas			X	X	X	X														
Public Way						X														
Publicly Funded																				
Qualified Historic Building or Facil- ity						X														
Radius of Curvature														X						
Raftertail		X																		
Ramp						X														
Readily Accessible														X						
Readily Disassembled														X						
Reasonable Portion						X														
Recessed Steps														X						
Recirculation System														X						
Recommend			X	X	X	X														
Relocatable Building (Public School)		X																		
Remodeling						X														

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
<i>Repair</i>						X			X			X								
<i>Residential Care Facility for the Chronically Ill (RCF/CI)</i>		X																		
<i>Residential Care Facility for the Elderly (RCFE)</i>		X																		
<i>Residential Dwelling Unit</i>						X														
<i>Residential Facility (RF)</i>		X																		
<i>Restraint [SFM]</i>		X																		
<i>Restricted Entrance</i>						X														
<i>Retrofit</i>		X					X	X	X	X		X								
<i>Rim Flow Gutter</i>														X						
<i>Riser</i>			X	X	X	X														
<i>Roof Eave</i>		X																		
<i>Roof Eave Soffit</i>		X																		
<i>Rugged Equipment</i>							X	X	X	X	X	X								
<i>Running Slope</i>			X	X	X	X														
<i>Sanitary Facility</i>			X	X	X															
<i>Secure Interview Rooms</i>		X																		
<i>Self-Service Storage</i>						X														
<i>Service Entrance</i>						X														
<i>Shall</i>						X														
<i>Shopping Center (or Shopping Mall)</i>						X														
<i>Should</i>			X	X	X	X														
<i>Sidewalk</i>			X	X	X	X														
<i>Signage</i>						X														
<i>Significant Loss of Function</i>							X	X	X	X		X								
<i>Single-Accommodation Sanitary Facility</i>			X	X	X															
<i>Sink</i>					X	X														
<i>Site</i>						X														
<i>Site Development</i>			X	X	X															
<i>Skimmer Equalizer Line</i>														X						
<i>Sleeping Accommodations</i>			X	X	X	X														
<i>Slip Resistant</i>														X						
<i>Slope</i>			X	X	X															
<i>Small Management Yard</i>		X																		
<i>Soft Contained Play Structure</i>						X														
<i>Sound Transmission Class (STC)</i>																				
<i>Spa Pool or Spa</i>														X						
<i>Space</i>			X	X	X	X														
<i>SPC 1, SPC 2, SPC 3, SPC 4 and SPC 5</i>									X			X								
<i>Special Purpose Pool</i>														X						

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
Specified Public Transportation						X														
<i>Splash Zone</i>														X						
<i>Spray Ground</i>														X						
<i>Springline</i>														X						
Stage						X														
<i>Stair</i>						X														
<i>Stairs</i>														X						
Stairway						X														
State-Owned/Leased Building [SFM]		X																		
<i>State Responsibility Area</i>		X																		
<i>Station</i>		X																		
<i>Station Platform</i>		X																		
<i>Step</i>														X						
<i>Story (2nd paragraph only)</i>						X														
Structural Frame						X														
Structure						X														
<i>Suction Outlet</i>														X						
<i>Surge Basin</i>														X						
<i>Substantial Structural Damage</i>		X							X			X								
<i>Tactile</i>			X	X	X	X														
<i>Tactile Sign</i>			X	X	X	X														
Technically Infeasible		X				X														
<i>Teeing Ground</i>						X														
<i>Tempered Water</i>														X						
<i>Temporary</i>						X														
<i>Temporary Holding Cell, Room or Area. [CSA and SFM]</i>		X											X							
<i>Temporary Holding Facility [SFM]</i>		X																		
<i>Tenable Environment [SFM]</i>		X																		
<i>Terminally Ill</i>		X																		
<i>Testing Agency</i>			X	X	X															
<i>Text Telephone</i>					X	X														
<i>Transfer Device</i>						X														
<i>Transient Lodging</i>			X	X	X	X														
<i>Transit Boarding Platform</i>						X														
<i>Transition Plate</i>						X														
<i>Tread</i>			X	X	X	X														
<i>TTY</i>					X	X														
<i>Turnover Time</i>														X						
<i>Underground Station</i>		X																		

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X	X	X		X								
Adopt only those sections that are listed below						X					X		X	X						
Chapter / Section																				
Uniformity Coefficient														X						
Unreasonable Hardship					X	X														
Use Zone						X														
Valuation Threshold						X														
Vehicular or Pedestrian Arrival Points			X	X	X															
Vehicular Way					X	X														
Voluntary Structural Alteration									X			X								
Wading Pool														X						
Waiting Room [SFM]		X																		
Walk			X	X	X	X														
Water Feature														X						
Waterline														X						
Wet Bar						X														
Wheelchair			X	X	X	X														
Wheelchair Space						X														
Wildfire		X																		
Wildfire Exposure		X																		
Wildland-Urban Interface Fire Area		X																		
Winery Caves		X																		
Work Area Equipment						X														
Workstation (2nd paragraph only)						X														

The state agency does not adopt sections identified by the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

## CHAPTER 2

# DEFINITIONS

### SECTION 201 GENERAL

**201.1 Scope.** Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

**201.2 Interchangeability.** Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

**201.3 Terms defined in other codes.** Where terms are not defined in this code and are defined in the *California Fire Code*, *California Mechanical Code* or *California Plumbing Code*, such terms shall have the meanings ascribed to them as in those codes.

**201.4 Terms not defined.** Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

*For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies. Webster's Third New International Dictionary of the English Language, Unabridged, shall be considered as providing ordinarily accepted meanings.*

### SECTION 202 DEFINITIONS

**24-HOUR CARE.** The actual time that a person is an occupant within a facility for the purpose of receiving care. It shall not include a facility that is open for 24 hours and is capable of providing care to someone visiting the facility during any segment of the 24 hours.

**AAC MASONRY.** Masonry made of autoclaved aerated concrete (AAC) units, manufactured without internal reinforcement and bonded together using thin- or thick-bed mortar.

**ACCESS AISLE. [DSA-AC].** An accessible pedestrian space adjacent to or between parking spaces that provides clearances in compliance with this code.

**ACCESSIBILITY. [DSA-AC & HCD 1-AC]** Accessibility is the combination of various elements in a building, facility, site, or area, or portion thereof which allows access, circulation and the full use of the building and facilities by persons with disabilities in compliance with this code.

**ACCESSIBLE. [DSA-AC & HCD 1-AC]** A site, building, facility, or portion thereof that is approachable and usable by persons with disabilities in compliance with this code.

**ACCESSIBLE ELEMENT. [DSA-AC]** An element specified by the regulations adopted by the Division of the State Architect-Access Compliance.

**ACCESSIBLE MEANS OF EGRESS.** A continuous and unobstructed way of egress travel from any accessible point in a building or facility to a public way.

**ACCESSIBLE ROUTE. [DSA-AC & HCD 1-AC]** A continuous unobstructed path connecting accessible elements and spaces of an accessible site, building or facility that can be negotiated by a person with a disability using a wheelchair, and that is also safe for and usable by persons with other disabilities. Interior accessible routes may include corridors, hallways, floors, ramps, elevators and lifts. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

**ACCESSIBLE SPACE. [DSA-AC]** A space that complies with the accessibility provisions of this code

**ACCREDITATION BODY.** An approved, third-party organization that is independent of the grading and inspection agencies, and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

**ACTIVE EQUIPMENT/COMPONENT. [DSA-SS, DSA-SS/CC & OSHPD 1, 2, 3 & 4]** Equipment/Component containing moving or rotating parts, electrical parts such as switches or relays, or other internal components that are sensitive to earthquake forces and critical to the function of the equipment.

**ADAPTABLE. [DSA-AC]** Capable of being readily modified and made accessible.

**ADAPTABLE DWELLING UNIT. [HCD 1-AC]** An accessible dwelling unit within a covered multifamily building as designed with elements and spaces allowing the dwelling unit to be adapted or adjusted to accommodate the user. See Chapter 11A, Division IV.

**[A] ADDITION.** An extension or increase in floor area or height of a building or structure. *[DSA-AC]* An expansion, extension or increase in the gross floor area or height of a building or facility.

**ADHERED MASONRY VENEER.** Veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

**ADMINISTRATIVE AUTHORITY. [DSA-AC]** A governmental agency that adopts or enforces regulations and guidelines for the design, construction or alteration of buildings and facilities.

**ADOBE CONSTRUCTION.** Construction in which the exterior load-bearing and nonload-bearing walls and partitions are of unfired clay masonry units, and floors, roofs and

## DEFINITIONS

interior framing are wholly or partly of wood or other approved materials.

**Adobe, stabilized.** Unfired clay masonry units to which admixtures, such as emulsified asphalt, are added during the manufacturing process to limit the units' water absorption so as to increase their durability.

**Adobe, unstabilized.** Unfired clay masonry units that do not meet the definition of "Adobe, stabilized."

**[F] AEROSOL.** A product that is dispensed from an aerosol container by a propellant. Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, Level 2 or Level 3.

**Level 1 aerosol products.** Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb) (20 kJ/g).

**Level 2 aerosol products.** Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

**Level 3 aerosol products.** Those with a total chemical heat of combustion that is greater than 13,000 Btu/lb (30 kJ/g).

**[F] AEROSOL CONTAINER.** A metal can or a glass or plastic bottle designed to dispense an aerosol. Metal cans shall be limited to a maximum size of 33.8 fluid ounces (1000 ml). Glass or plastic bottles shall be limited to a maximum size of 4 fluid ounces (118 ml).

**AGED HOME OR INSTITUTION.** A facility used for the housing of persons 65 years of age or older in need of care and supervision. (See definition of "care and supervision")

**AGGREGATE.** In roofing, crushed stone, crushed slag or water-worn gravel used for surfacing for roof coverings.

**AGRICULTURAL BUILDING.** A structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

**AIR-INFLATED STRUCTURE.** A structure that uses air-pressurized membrane beams, arches or other elements to enclose space. Occupants of such a structure do not occupy the pressurized area used to support the structure.

**AIR-SUPPORTED STRUCTURE.** A structure wherein the shape of the structure is attained by air pressure and occupants of the structure are within the elevated pressure area. Air-supported structures are of two basic types:

**Double skin.** Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an airspace which serves for insulation, acoustic, aesthetic or similar purposes.

**Single skin.** Where there is only the single outer skin and the air pressure is directly against that skin.

**AISLE.** An unenclosed exit access component that defines and provides a path of egress travel. *[DSA-AC] A circulation path between objects such as seats, tables, merchandise,*

*equipment, displays, shelves, desks, etc., that provides clearances in compliance with this code.*

**AISLE ACCESSWAY.** That portion of an exit access that leads to an aisle.

**[F] ALARM NOTIFICATION APPLIANCE.** A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof.

**[F] ALARM SIGNAL.** A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

**[F] ALARM VERIFICATION FEATURE.** A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being *automatically* reset, in order to be accepted as a valid alarm-initiation signal.

**ALLOWABLE STRESS DESIGN.** A method of proportioning structural members, such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called "working stress design").

**[A] ALTERATION.** Any construction or renovation to an existing structure other than repair or addition. *[DSA-AC] A change, addition or modification in construction, change in occupancy or use, or structural repair to an existing building or facility. Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historic restoration, resurfacing of circulation paths or vehicular ways, changes or rearrangement of the structural parts or elements, and changes or rearrangement in the plan configuration of walls and full-height partitions. Normal maintenance, reroofing, painting or wallpapering, or changes to mechanical and electrical systems are not alterations unless they affect the usability of the building or facility.*

**ALTERNATING TREAD DEVICE.** A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

**ALTERNATIVE SYSTEM.** *[OSHPD 1 & 4] Alternative materials, design and methods of construction in accordance with Section 104.11, Section 11.1.4 of ASCE 7 or structural design criteria as approved by the enforcement agency.*

**AMBULATORY CARE FACILITY.** Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less than 24-hour basis to individuals who are rendered incapable of self-preservation by the services provided.

**AMUSEMENT ATTRACTION.** *[DSA-AC] Any facility, or portion of a facility, located within an amusement park or theme park which provides amusement without the use of an amusement device. Amusement attractions include, but are not limited to, fun houses, barrels and other attractions without seats.*



**AMUSEMENT RIDE.** [DSA-AC] A system that moves persons through a fixed course within a defined area for the purpose of amusement.

**AMUSEMENT RIDE SEAT.** [DSA-AC] A seat that is built-in or mechanically fastened to an amusement ride intended to be occupied by one or more passengers.

**ANCHOR.** Metal rod, wire or strap that secures masonry to its structural support.

**ANCHOR BUILDING.** An exterior perimeter building of a group other than H having direct access to a covered or open mall building but having required means of egress independent of the mall.

**ANCHORED MASONRY VENEER.** Veneer secured with approved mechanical fasteners to an approved backing

**ANNULAR SPACE.** The opening around the penetrating item.

**[F] ANNUNCIATOR.** A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

**ANSI.** [DSA-AC] The American National Standards Institute.

**[A] APPROVED.** Acceptable to the building official or authority having jurisdiction.

*[HCD 1, HCD 2 & DSA-AC] "Approved" means meeting the approval of the enforcing agency, except as otherwise provided by law, when used in connection with any system, material, type of construction, fixture or appliance as the result of investigations and tests conducted by the agency, or by reason of accepted principles or tests by national authorities or technical, health or scientific organizations or agencies.*

**Notes:** [HCD 1 & HCD 2]

1. See Health and Safety Code Section 17920 for "Approved" as applied to residential construction and buildings or structures accessory thereto, as referenced in Section 1.8.2.1.1.
- > 2. See Health and Safety Code Section 17921.1 for "Approved" as applied to the use of hotplates in residential construction referenced in Section 1.8.2.1.1.
- || 3. See Health and Safety Code Section 19966 for "Approved" as applied to factory-built housing as referenced in Section 1.8.3.2.5.
- || 4. See Health and Safety Code Section 18201 for "Approved" as applied to mobilehome parks as referenced in Section 1.8.2.1.3.
- || 5. See Health and Safety Code Section 18862.1 for "Approved" as applied to special occupancy parks as referenced in Section 1.8.2.1.3.

**[A] APPROVED AGENCY.** An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.

*[HCD 1 & HCD 2] "Approved agency" shall mean "Listing agency" and "Testing agency".*

**APPROVED FABRICATOR.** An established and qualified person, firm or corporation approved by the building official pursuant to Chapter 17 of this code.

**APPROVED LISTING AGENCY.** [HCD 1 & HCD 2] Any agency approved by the enforcing agency, unless otherwise provided by law, which is in the business of listing and labeling and which makes available at least an annual published report of such listings in which specific information is included that the product has been tested to recognized standards and found to comply.

**APPROVED SOURCE.** An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

**APPROVED TESTING AGENCY.** [HCD 1, HCD 2 & DSA-AC] Any agency, which is determined by the enforcing agency, except as otherwise provided by law, to have adequate personnel and expertise to carry out the testing of systems, materials, types of construction, fixtures or appliances.

**ARCHITECTURAL TERRA COTTA.** Plain or ornamental hard-burned modified clay units, larger in size than brick, with glazed or unglazed ceramic finish.

**AREA (for masonry).**

**Gross cross-sectional.** The area delineated by the out-to-out specified dimensions of masonry in the plane under consideration.

**Net cross-sectional.** The area of masonry units, grout and mortar crossed by the plane under consideration based on out-to-out specified dimensions.

**AREA, BUILDING.** The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

**AREA OF REFUGE.** An area where persons unable to use stairways can remain temporarily to await instructions or assistance during emergency evacuation.

**AREA OF SPORT ACTIVITY.** [DSA-AC] That portion of a room or space where the play or practice of a sport occurs.

**AREAWAY.** A subsurface space adjacent to a building open at the top or protected at the top by a grating or guard.

**ASSEMBLY AREA.** [DSA-AC] A building or facility, or portion thereof, used for the purpose of entertainment, educational or civic gatherings, or similar purposes. For the purposes of these requirements, assembly areas include, but are not limited to, classrooms, lecture halls, courtrooms, public meeting rooms, public hearing rooms, legislative chambers, motion picture houses, auditoria, theaters, playhouses, dinner theaters, concert halls, centers for the performing arts, amphitheaters, arenas, stadiums, grandstands or convention centers.

**ASSEMBLY SEATING, MULTILEVEL.** See "Multilevel assembly seating."

## DEFINITIONS

**ASSISTIVE DEVICE. [HCD 1-AC]** *An aid, tool or instrument used by persons with disabilities to assist in activities of daily living.*

**ASSISTIVE LISTENING SYSTEM (ALS). [DSA-AC]** *An amplification system utilizing transmitters, receivers and coupling devices to bypass the acoustical space between a sound source and a listener by means of induction loop, radio frequency, infrared or direct-wired equipment.*

**AT-GRADE STATION. [SFM]** *(See Chapter 4, Section 433 for definition of term.)*

**ATRIUM.** An opening connecting two or more stories other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505.

**ATTIC.** The space between the ceiling beams of the top story and the roof rafters.

**[F] AUDIBLE ALARM NOTIFICATION APPLIANCE.** A notification appliance that alerts by the sense of hearing.

**AUTOCLAVED AERATED CONCRETE (AAC).** Low density cementitious product of calcium silicate hydrates, whose material specifications are defined in ASTM C 1386.

**[F] AUTOMATIC.** As applied to fire protection devices, a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise or combustion products.

**AUTOMATIC DOOR.** *A door equipped with a power-operated mechanism and controls that open and close the door automatically upon receipt of a momentary actuating signal. The switch that begins the automatic cycle may be a photo-electric device, floor mat or manual switch.*

**[F] AUTOMATIC FIRE-EXTINGUISHING SYSTEM.** An approved system of devices and equipment which automatically detects a fire and discharges an approved fire-extinguishing agent onto or in the area of a fire.

**[F] AUTOMATIC SMOKE DETECTION SYSTEM.** A fire alarm system that has initiation devices that utilize smoke detectors for protection of an area such as a room or space with detectors to provide early warning of fire.

**[F] AUTOMATIC SPRINKLER SYSTEM.** An automatic sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

**AUTOMATIC TELLER MACHINE (ATM). [DSA-AC]** *Any electronic information processing device that accepts or dispenses cash in connection with a credit, deposit or con-*

*venience account. The term does not include devices used solely to facilitate check guarantees or check authorizations, or which are used in connection with the acceptance or dispensing of cash on a person-to-person basis, such as by a store cashier.*

**AUXILIARY AREA.** *A public dressing, locker, shower or toilet area or building space intended to be used by bathers.*

**[F] AVERAGE AMBIENT SOUND LEVEL.** The root mean square, A-weighted sound pressure level measured over a 24-hour period, or the time any person is present, whichever time period is less.

**AWNING.** An architectural projection that provides weather protection, identity or decoration and is partially or wholly supported by the building to which it is attached. An awning is comprised of a lightweight frame structure over which a covering is attached.

**BACKING.** The wall or surface to which the veneer is secured.

**BACKWASH.** *Is the process of thoroughly cleansing the filter media and/or elements and the contents of the filter vessel.*

**[F] BALED COTTON.** A natural seed fiber wrapped in and secured with industry accepted materials, usually consisting of burlap, woven polypropylene, polyethylene or cotton or sheet polyethylene, and secured with steel, synthetic or wire bands or wire; also includes linters (lint removed from the cottonseed) and motes (residual materials from the ginning process).

**[F] BALED COTTON, DENSELY PACKED.** Cotton made into banded bales with a packing density of at least 22 pounds per cubic foot (360 kg/m<sup>3</sup>), and dimensions complying with the following: a length of 55 inches (1397 mm), a width of 21 inches (533.4 mm) and a height of 27.6 to 35.4 inches (701 to 899 mm).

**BALLAST.** In roofing, ballast comes in the form of large stones or paver systems or light-weight interlocking paver systems and is used to provide uplift resistance for roofing systems that are not adhered or mechanically attached to the roof deck.

**[F] BARRICADE.** A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from explosive materials by a natural or artificial barrier.

**Artificial barricade.** An artificial mound or revetment a minimum thickness of 3 feet (914 mm).

**Natural barricade.** Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

**BASE FLOOD.** The flood having a 1-percent chance of being equaled or exceeded in any given year.

**BASE FLOOD ELEVATION.** The elevation of the base flood, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical

Datum (NAVD) or other datum specified on the *Flood Insurance Rate Map (FIRM)*.

**BASEMENT (for flood loads).** The portion of a building having its floor subgrade (below ground level) on all sides. This definition of “Basement” is limited in application to the provisions of Section 1612.

**BASEMENT.** A story that is not a story above grade plane (see “Story above grade plane”). This definition of “Basement” does not apply to the provisions of Section 1612 for flood loads.

**BATHER.** A person using a pool and adjoining deck areas for the purpose of water sports such as diving, swimming, wading or related activities.

**BATHROOM.** For the purposes of Chapters 11A and 11B, a room which includes a water closet (toilet), a lavatory, and a bathtub and/or a shower. It does not include single-fixture facilities or those with only a water closet and lavatory. It does include a compartmented bathroom. A compartmented bathroom is one in which the fixtures are distributed among interconnected rooms. A compartmented bathroom is considered a single unit and is subject to the requirements of Chapters 11A and 11B.

**BEARING WALL STRUCTURE.** A building or other structure in which vertical loads from floors and roofs are primarily supported by walls.

**BED JOINT.** The horizontal layer of mortar on which a masonry unit is laid.

**BEDRIDDEN PERSON.** A person, requiring assistance in turning and repositioning in bed, or being unable to independently transfer to and from bed, except in facilities with appropriate and sufficient care staff, mechanical devices if necessary, and safety precautions as determined in Title 22 regulations, by the Director of Social Services or his or her designated representative. Persons who are unable to independently transfer to and from bed, but who do not need assistance to turn or reposition in bed, shall be considered nonambulatory.

*The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of persons with developmental disabilities, in consultation with the Director of Developmental Services or his or her designated representative.*

*The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of all other persons with disabilities who are not developmentally disabled.*

**BLEACHERS.** Tiered seating supported on a dedicated structural system and two or more rows high and is not a building element (see “Grandstands”).

**BLENDED TRANSITION. [DSA-AC]** A raised pedestrian street crossing, depressed corner or similar connection between the pedestrian access route at the level of the sidewalk and the level of the pedestrian street crossing that has a grade of 5 percent or less.

**BOARDING HOUSE.** A building arranged or used for lodging for compensation, with or without meals, and not occupied as a single-family unit.

**BOARDING PIER. [DSA-AC]** A portion of a pier where a boat is temporarily secured for the purpose of embarking or disembarking.

**BOAT LAUNCH RAMP. [DSA-AC]** A sloped surface designed for launching and retrieving trailered boats and other water craft to and from a body of water.

**BOAT SLIP. [DSA-AC]** That portion of a pier, main pier, finger pier or float where a boat is moored for the purpose of berthing, embarking or disembarking.

**[F] BOILING POINT.** The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch (psia) (101 kPa) or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D 86 shall be used as the boiling point of the liquid.

**BOND BEAM.** A horizontal grouted element within masonry in which reinforcement is embedded.

**BRACED WALL LINE.** A series of braced wall panels in a single story that meets the requirements of Section 2308.3 or 2308.12.4.

**BRACED WALL PANEL.** A section of wall braced in accordance with Section 2308.9.3 or 2308.12.4.

**BRICK.**

**Calcium silicate (sand lime brick).** A pressed and subsequently autoclaved unit that consists of sand and lime, with or without the inclusion of other materials.

**Clay or shale.** A solid or hollow masonry unit of clay or shale, usually formed into a rectangular prism, then burned or fired in a kiln; brick is a ceramic product.

**Concrete.** A concrete masonry unit made from Portland cement, water, and suitable aggregates, with or without the inclusion of other materials.

**[A] BUILDING.** Any structure used or intended for supporting or sheltering any use or occupancy.

**Exception: [HCD 1, HCD 2 & HCD 1-AC]** For applications listed in Section 1.8.2 regulated by the Department of Housing and Community Development, “Building” shall not include the following:

1. Any mobilehome as defined in Health and Safety Code Section 18008.
2. Any manufactured home as defined in Health and Safety Code Section 18007.
3. Any commercial modular as defined in Health and Safety Code Section 18001.8 or any special purpose commercial modular as defined in Section 18012.5.
4. Any recreational vehicle as defined in Section Health and Safety Code 18010.

## DEFINITIONS

5. Any multifamily manufactured home as defined in Health and Safety Code Section 18008.7.

For additional information, see Health and Safety Code Section 18908.

**Note:** Building shall have the same meaning as defined in Health and Safety Code Section 17920 and 18908 for the applications specified in Section 1.11.

**BUILDING AREA.** See “Area, building.”

**BUILDING ELEMENT.** A fundamental component of building construction, listed in Table 601, which may or may not be of fire-resistance-rated construction and is constructed of materials based on the building type of construction.

**BUILDING ENTRANCE ON AN ACCESSIBLE ROUTE. [HCD 1-AC]** An accessible entrance to a building that is connected by an accessible route to public transportation stops, to parking or passenger loading zones, or to public streets or sidewalks, if available.

**BUILDING, EXISTING. [HCD 1 & HCD 2]** A building erected prior to the adoption of this code, or one for which a legal building permit has been issued.

**BUILDING HEIGHT.** See “Height, building.”

**BUILDING LINE.** The line established by law, beyond which a building shall not extend, except as specifically provided by law.

**[A] BUILDING OFFICIAL.** The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

**BUILT-UP ROOF COVERING.** Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

**CABLE-RESTRAINED, AIR-SUPPORTED STRUCTURE.** A structure in which the uplift is resisted by cables or webbings which are anchored to either foundations or dead men. Reinforcing cable or webbing is attached by various methods to the membrane or is an integral part of the membrane. This is not a cable-supported structure.

**CANOPY.** A permanent structure or architectural projection of rigid construction over which a covering is attached that provides weather protection, identity or decoration. A canopy is permitted to be structurally independent or supported by attachment to a building on one or more sides.

**[F] CARBON DIOXIDE EXTINGUISHING SYSTEMS.** A system supplying carbon dioxide (CO<sub>2</sub>) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or automatic-actuating mechanism.

**CARE AND SUPERVISION.** Any one or more of the following activities provided by a person or facility to meet the needs of the clients:

Assistance in dressing, grooming, bathing and other personal hygiene.

Assistance with taking medication.

Central storing and/or distribution of medications.

Arrangement of and assistance with medical and dental care.

Maintenance of house rules for the protection of clients.

Supervision of client schedules and activities.

Maintenance and/or supervision of client cash resources or property.

Monitoring food intake or special diets.

Providing basic services required by applicable law and regulation to be provided by the licensee in order to obtain and maintain a community-care facility license.

**CARE SUITE.** A group of treatment rooms, care recipient sleeping rooms and their associated support rooms or spaces and circulation space within Group I-2 occupancies where staff are in attendance for supervision of all care recipients within the suite, and the suite is in compliance with the requirements of Section 407.4.3.

**CARRIAGE UNIT. [HCD 1-AC]** A dwelling unit with living space on one or more floors immediately above a Group U, private garage or garages. The footprint of the garage or garages is used as the footprint for the remaining floor or floors of the units above and the garage level contains no habitable space.

**Note:** Dwelling units located over a common garage shall not be considered carriage units.

**CAST STONE.** A building stone manufactured from Portland cement concrete precast and used as a trim, veneer or facing on or in buildings or structures.

**CATASTROPHICALLY INJURED.** As termed, means a person whose origin of disability was acquired through trauma or nondegenerative neurologic illness, for whom it has been determined by the Department of Health Services Certification and Licensing that active rehabilitation would be beneficial.

**CATCH POOL. [DSA-AC]** A pool or designated section of a pool used as a terminus for water slide flumes.

**CCR. [DSA-AC]** The California Code of Regulations.

**CDF DIRECTOR. [SFM]** (See Chapter 7A, Section 702A for defined term.)

**[F] CEILING LIMIT.** The maximum concentration of an air-borne contaminant to which one may be exposed. The ceiling limits utilized are those published in DOL 29 CFR Part 1910.1000. The ceiling Recommended Exposure Limit (REL-C) concentrations published by the U.S. National Institute for Occupational Safety and Health (NIOSH), Threshold Limit Value—Ceiling (TLV-C) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), Ceiling Work place Environmental Exposure Level (WEEL-Ceiling) Guides published by the American Industrial Hygiene Association (AIHA), and other approved, consistent measures are allowed as surrogates for hazardous substances not listed in DOL 29 CFR Part 1910.1000.

**CEILING RADIATION DAMPER.** A listed device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening.

**CELL (Detention or correctional facility) [SFM].** A sleeping or housing unit in a detention or correctional facility for the confinement of not more than two inmates or prisoners.

**CELL (masonry).** A void space having a gross cross-sectional area greater than 1½ square inches (967 mm<sup>2</sup>).

**CELL COMPLEX.** *A cluster or group of cells or dormitories in a jail, prison or other detention facility, together with rooms used for accessory purposes, all of which open into the cell complex, and are used for functions such as dining, counseling, exercise, classrooms, sick call, visiting, storage, staff offices, control rooms or similar functions, and interconnecting corridors all within the cell complex.*

**CELL TIER.** Levels of cells vertically stacked above one another within a housing unit.

**CELL TIERS.** *Cells, dormitories and accessory spaces. Cell tiers are located one level above the other, and do not exceed two levels per floor. A cell tier shall not be considered a story or mezzanine.*

**CELLULAR CONCRETE.** *[HCD 1 & HCD 2] A lightweight product consisting of portland cement and selected gas-forming chemicals or foaming agents which create homogeneous voids in the hardened concrete.*

**CEMENT PLASTER.** A mixture of portland or blended cement, Portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in this code.

**CENTRAL CONTROL BUILDING.** *A secure building within a prison where the fire and life safety systems, communication systems, security systems and exterior lighting systems are monitored and where security operations necessitate the remote locking of required means of egress or at the door with a key to maintain a high security area*

**CERAMIC FIBER BLANKET.** A mineral wool insulation material made of alumina-silica fibers and weighing 4 to 10 pounds per cubic foot (pcf) (64 to 160 kg/m<sup>3</sup>).

**CERTIFICATE OF COMPLIANCE.** A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents.

**CHARACTERS.** Letters, numbers, punctuation marks and typographic symbols.

**CHARTER SCHOOL** *A public school providing instruction from kindergarten through 12th grade, established pursuant to Education Code, Title 2, Division 4, Part 26.8, Section 47600, et seq.*

**CHILD CARE CENTER.** *Any facility of any capacity other than a large or small family day-care home as defined in these regulations in which less than 24-hour-per-day nonmedical supervision is provided for children in a group setting.*

**CHILD OR CHILDREN.** A person or persons under the age of 18 years.

**CHILDREN'S USE.** *[DSA-AC] Describes spaces and elements specifically designed for use primarily by people 12 years old and younger.*

**[M] CHIMNEY.** A primarily vertical enclosure containing one or more passageways for conveying flue gases to the outside atmosphere.

**CHIMNEY TYPES.**

**High-heat appliance type.** An approved chimney for removing the products of combustion from fuel-burning, high-heat appliances producing combustion gases in excess of 2000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.3).

**Low-heat appliance type.** An approved chimney for removing the products of combustion from fuel-burning, low-heat appliances producing combustion gases not in excess of 1000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1400°F (760°C) during intermittent forces firing for periods up to 1 hour. Temperatures shall be measured at the appliance flue outlet.

**Masonry type.** A field-constructed chimney of solid masonry units or stones.

**Medium-heat appliance type.** An approved chimney for removing the products of combustion from fuel-burning, medium-heat appliances producing combustion gases not exceeding 2000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.2).

**CHRONICALLY ILL.** *See "Terminally ill."*

**CIRCULATION PATH.** An exterior or interior way of passage from one place to another for pedestrians. *[DSA-AC] An exterior or interior way of passage provided for pedestrian travel, including but not limited to, walks, hallways, courtyards, elevators, platform lifts, ramps, stairways and landings.*

**[F] CLEAN AGENT.** Electrically nonconducting, volatile or gaseous fire extinguishant that does not leave a residue upon vaporation.

**CLEANOUT.** An opening to the bottom of a grout space of sufficient size and spacing to allow the removal of debris.

**CLEAN POOL WATER.** *Is a pool water that is free of dirt, oils, scum, algae, floating materials or other visible organic and inorganic materials that would sully the water.*

**CLEAR.** *[DSA-AC] Unobstructed.*

**CLEAR FLOOR SPACE.** *[DSA-AC] The minimum unobstructed floor or ground space required to accommodate a single, stationary wheelchair and occupant.*

**CLEAR POOL WATER.** *Pool water that is free from cloudiness and is transparent.*

**CLINIC, OUTPATIENT.** Buildings or portions thereof used to provide medical care on less than a 24-hour basis to persons who are not rendered incapable of self-preservation by the services provided.

**CLOSED-CIRCUIT TELEPHONE.** *[DSA-AC] A telephone with a dedicated line such as a house phone, courtesy phone or phone that must be used to gain entry to a facility.*

**[F] CLOSED SYSTEM.** The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of compressed gases. Examples of closed systems for solids and liquids include product con-

## DEFINITIONS

veyed through a piping system into a closed vessel, system or piece of equipment.

**COLLAR JOINT.** Vertical longitudinal space between wythes of masonry or between masonry wythe and backup construction that is permitted to be filled with mortar or grout.

**COLLECTOR.** A horizontal diaphragm element parallel and in line with the applied force that collects and transfers diaphragm shear forces to the vertical elements of the lateral-force-resisting system and/or distributes forces within the diaphragm.

**COMBINATION FIRE/SMOKE DAMPER.** A listed device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center

**[F] COMBUSTIBLE DUST.** Finely divided solid material that is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a U.S. No. 40 standard sieve.

**[F] COMBUSTIBLE FIBERS.** Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials. This definition does not include densely packed baled cotton.

**[F] COMBUSTIBLE LIQUID.** A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

**Class II.** Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

**Class IIIA.** Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

**Class IIIB.** Liquids having a closed cup flash point at or above 200°F (93°C).

The category of combustible liquids does not include compressed gases or cryogenic fluids.

**COMMERCIAL FACILITIES [DSA-AC]** *Facilities whose operations will affect commerce and are intended for non-residential use by a private entity. Commercial facilities shall not include (1) facilities that are covered or expressly exempted from coverage under the Fair Housing Act of 1968, as amended (42 U.S.C. 3601 - 3631); (2) aircraft; or (3) railroad locomotives, railroad freight cars, railroad cabooses, commuter or intercity passenger rail cars (including coaches, dining cars, sleeping cars, lounge cars and food service cars), any other railroad cars described in Section 242 of the Americans With Disabilities Act or covered under Title II of the Americans With Disabilities Act, or railroad rights-of-way. For purposes of this definition, "rail" and "railroad" have the meaning given the term "railroad" in Section 202(e)*

*of the Federal Railroad Safety Act of 1970 (45 U.S.C. 431(e)).*

**COMMON PATH OF EGRESS TRAVEL.** That portion of exit access which the occupants are required to traverse before two separate and distinct paths of egress travel to two exits are available. Paths that merge are common paths of travel. Common paths of egress travel shall be included within the permitted travel distance.

**COMMON USE.** Interior or exterior circulation paths, rooms, spaces or elements that are not for public use and are made available for the shared use of two or more people.

**COMMON USE AREAS. [HCD 1-AC]** *Private use areas within multifamily residential facilities where the use of these areas is limited exclusively to owners, residents and their guests. The areas may be defined as rooms or spaces or elements inside or outside of a building.*

**COMMUNITY CARE FACILITY.** *Any facility, place or building that is maintained and operated to provide nonmedical residential care, day treatment, adult day care or foster family agency services for children, adults, or children and adults, including, but not limited to, the physically handicapped, mentally impaired, incompetent persons, and abused or neglected children, and includes the following as defined in Health and Safety Code Section 1502:*

1. Residential facility
2. Adult day program
3. Therapeutic day services facility
4. Foster family agency
5. Foster family home
6. Small-family home
7. Social rehabilitation facility
8. Community treatment facility
9. Full-service adoption agency
10. Noncustodial adoption agency
11. Transitional shelter care facility
12. Transitional housing placement facility

**COMPLY WITH. [DSA-AC]** *Comply with means to meet one or more provisions of this code.*

**[F] COMPRESSED GAS.** A material, or mixture of materials, that:

1. Is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure; and
2. Has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health- or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

1. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the

charged pressure and are entirely gaseous at a temperature of 68°F (20°C).

2. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially liquid at a temperature of 68°F (20°C).
3. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

**COMPRESSIVE STRENGTH OF MASONRY.** Maximum compressive force resisted per unit of net cross-sectional area of masonry, determined by the testing of masonry prisms

## CONCRETE

**Carbonate aggregate.** Concrete made with aggregates consisting mainly of calcium or magnesium carbonate, such as limestone or dolomite, and containing 40 percent or less quartz, chert or flint.

> || **Cellular.** See *CELLULAR CONCRETE*.

**Lightweight aggregate.** Concrete made with aggregates of expanded clay, shale, slag or slate or sintered fly ash or any natural lightweight aggregate meeting ASTM C 330 and possessing equivalent fire-resistance properties and weighing 85 to 115 pcf (1360 to 1840 kg/m<sup>3</sup>).

**Perlite.** A lightweight insulating concrete having a dry unit weight of approximately 30 pcf (480 kg/m<sup>3</sup>) made with perlite concrete aggregate. Perlite aggregate is produced from a volcanic rock which, when heated, expands to form a glass-like material of cellular structure.

**Sand-lightweight.** Concrete made with a combination of expanded clay, shale, slag, slate, sintered fly ash, or any natural lightweight aggregate meeting ASTM C 330 and possessing equivalent fire-resistance properties and natural sand. Its unit weight is generally between 105 and 120 pcf (1680 and 1920 kg/m<sup>3</sup>).

**Siliceous aggregate.** Concrete made with normal-weight aggregates consisting mainly of silica or compounds other than calcium or magnesium carbonate, which contains more than 40-percent quartz, chert or flint.

**Vermiculite.** A light weight insulating concrete made with vermiculite concrete aggregate which is laminated micaceous material produced by expanding the ore at high temperatures. When added to a Portland cement slurry the resulting concrete has a dry unit weight of approximately 30 pcf (480 kg/m<sup>3</sup>).

> **CONGREGATE LIVING HEALTH FACILITY (CLHF).** As termed, is a residential home with a capacity of no more than six beds, which provides inpatient care, including the following basic services: medical supervision, 24-hour skilled nursing and supportive care, pharmacy, dietary, social recreational, and at least provides services for persons who are diagnosed with a terminal illness or who are catastrophically and severely disabled.

**CONGREGATE RESIDENCE.**—Any building or portion thereof that contains facilities for living, sleeping and sanitation, as required by this code, and may include facilities for eating and cooking, for occupancy by other than a family. A congregate residence may be a shelter, convent, monastery, dormitory, fraternity or sorority house, but does not include jails, hospitals, nursing homes, hotels or lodging houses.

**[F] CONSTANTLY ATTENDED LOCATION.** A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.

**[A] CONSTRUCTION DOCUMENTS.** Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.

**CONSTRUCTION TYPES.** See Section 602.

**Type I.** See Section 602.2.

**Type II.** See Section 602.2.

**Type III.** See Section 602.3.

**Type IV.** See Section 602.4.

**Type V.** See Section 602.5.

**[F] CONTINUOUS GAS DETECTION SYSTEM.** A gas detection system where the analytical instrument is maintained in continuous operation and sampling is performed without interruption. Analysis is allowed to be performed on a cyclical basis at intervals not to exceed 30 minutes.

**[F] CONTROL AREA.** Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See also the definition of “Outdoor control area” in the *California Fire Code*.

**CONTROLLED LOW-STRENGTH MATERIAL.** A self-compacted, cementitious material used primarily as a backfill in place of compacted fill.

**CONVENTIONAL LIGHT-FRAME CONSTRUCTION.** A type of construction whose primary structural elements are formed by a system of repetitive wood-framing members. See Section 2308 for conventional light-frame construction provisions.

**CORNICE.** A projecting horizontal molded element located at or near the top of an architectural feature.

**CORRIDOR.** An enclosed exit access component that defines and provides a path of egress travel.

**CORROSION RESISTANCE.** The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

**CORROSION RESISTANT.** Capable of maintaining original surface characteristics under the prolonged influence of the use environment.

**[F] CORROSIVE.** A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits

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by the method described in DOTn 49 CFR, Part 173.137, such chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.

**COURT.** An open, uncovered space, unobstructed to the sky, bounded on three or more sides by exterior building walls or other enclosing devices.

**COURTROOM DOCK.** An area within a courtroom where persons may be restrained and are awaiting court proceedings.

**COURTHOUSE HOLDING FACILITY [SFM].** A room, cell, cell complex or building for the confinement of persons for the purpose of a court appearance for a period not to exceed 12 hours.

**COVERED MALL BUILDING.** A single building enclosing a number of tenants and occupants, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices and other similar uses wherein two or more tenants have a main entrance into one or more malls. Anchor buildings shall not be considered as a part of the covered mall building. The term “covered mall building” shall include open mall buildings as defined below.

**Mall.** A roofed or covered common pedestrian area within a covered mall building that serves as access for two or more tenants and not to exceed three levels that are open to each other. The term “mall” shall include open malls as defined below.

**Open mall.** An unroofed common pedestrian way serving a number of tenants not exceeding three levels. Circulation at levels above grade shall be permitted to include open exterior balconies leading to exits discharging at grade.

**Open mall building.** Several structures housing a number of tenants, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, offices, and other similar uses, wherein two or more tenants have a main entrance into one or more open malls. Anchor buildings are not considered as a part of the open mall building.

**COVERED MULTIFAMILY DWELLINGS. [HCD 1-AC]** Dwelling units in buildings consisting of 3 or more dwelling units or 4 or more condominium units. Covered multifamily dwellings include dwelling units listed in Section 1102A.1. Dwelling units within a single structure separated by firewalls do not constitute separate buildings.

**Note:** For buildings or complexes containing public housing, see Chapter 11B for provisions of the Division of the State Architect–Access Compliance (DSA-AC).

**CRIPPLE WALL.** A framed stud wall extending from the top of the foundation to the underside of floor framing for the lowest occupied floor level.

**CROSS SLOPE.** The slope that is perpendicular to the direction of travel.

**[F] CRYOGENIC FLUID.** A liquid having a boiling point lower than -150°F (-101°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101 kPa).

**CURB CUT.** An interruption of a curb at a pedestrian way, which separates surfaces that are substantially at the same elevation.

**CURB RAMP.** A sloping pedestrian way, intended for pedestrian traffic, which provides access between a walk or sidewalk and a surface located above or below an adjacent curb face.

**CUSTODIAL CARE.** Assistance with day-to-day living tasks; such as assistance with cooking, taking medication, bathing, using toilet facilities and other tasks of daily living. Custodial care include occupants who evacuate at a slower rate and/or who have mental and psychiatric complications.

**DALLE GLASS.** A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

**DAMPER.** See “Ceiling radiation damper,” “Combination fire/smoke damper,” “Fire damper” and “Smoke damper.”

**DANGEROUS.** Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgment of any portion, member, appurtenance or ornamentation of the building or structure under service loads.

**[F] DAY BOX.** A portable magazine designed to hold explosive materials constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 56 of the *California Fire Code*.

**DAY-CARE.** For the purposes of these regulations, means the care of persons during any period of a 24-hour day where permanent sleeping accommodations are not provided.

**Note:** “Daycare” shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

**DAY-CARE HOME, FAMILY.** A home that regularly provides care, protection and supervision for 14 or fewer children, in the provider’s own home, for periods of less than 24 hours per day, while the parents or guardians are away, and is either a large family day-care home or a small family day-care home.

**DAY-CARE HOME, LARGE FAMILY.** A provider’s own home which is licensed to provide day care for periods less than 24 hours per day for nine to 14 persons, including children under the age of 10 years who reside at the home.

**DAY-CARE HOME, SMALL FAMILY.** A home which provides family day-care to eight or fewer children, including children under the age of 10 years who reside at the home, in the provider’s own home, for periods of less than 24 hours per day. Small family day-care homes are exempted from state fire and life safety regulations other than those state and local standards applicable to Group R-3 occupancies. (See *Health and Safety Code, Section 13143 (b).*)



**DAY ROOM.** *A room which is adjacent to a cell, or cell tier, or dormitory and which is used as a dining, exercise or other activity room for inmates.*

**DEAD LOAD.** The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and the weight of fixed service equipment, such as cranes, plumbing stacks and risers, electrical feeders, heating, ventilating and air-conditioning systems and automatic sprinkler systems.

**DECK.** *Is an area surrounding a pool which is specifically constructed or installed for use by bathers.*

**DECORATIVE GLASS.** A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material and whose surface, or assembly into which it is incorporated, is divided into segments.

**[F] DECORATIVE MATERIALS.** All materials applied over the building interior finish for decorative, acoustical or other effect (such as curtains, draperies, fabrics, streamers and surface coverings), and all other materials utilized for decorative effect (such as batting, cloth, cotton, hay, stalks, straw, vines, leaves, trees, moss and similar items), including foam plastics and materials containing foam plastics. Decorative materials do not include floor coverings, ordinary window shades, interior finish and materials 0.025 inch (0.64 mm) or less in thickness applied directly to and adhering tightly to a substrate.

**DEEP FOUNDATION.** A deep foundation is a foundation element that does not satisfy the definition of a shallow foundation.

**[F] DEFLAGRATION.** An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

**[F] DELUGE SYSTEM.** A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

**DEPARTMENT.** *[HCD 1 & HCD 2] The Department of Housing and Community Development.*

**DESIGN DISPLACEMENT.** See Section 1905.1.1.

**DESIGN EARTHQUAKE GROUND MOTION.** The earthquake ground motion that buildings and structures are specifically proportioned to resist in Section 1613.

**DESIGN FLOOD.** The flood associated with the greater of the following two areas:

1. Area with a flood plain subject to a 1-percent or greater chance of flooding in any year; or

2. Area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.

**DESIGN FLOOD ELEVATION.** The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the design flood elevation shall be the elevation of the highest existing grade of the building's perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

**DESIGN PROFESSIONAL, REGISTERED.** See "Registered design professional."

**DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE, REGISTERED.** See "Registered design professional in responsible charge."

**DESIGN STRENGTH.** The product of the nominal strength and a resistance factor (or strength reduction factor).

**DESIGNATED SEISMIC SYSTEM.** Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7 and for which the component importance factor,  $I_p$ , is greater than 1 in accordance with Section 13.1.3 of ASCE 7.

**[F] DETACHED BUILDING.** A separate single-story building, without a basement or crawl space, used for the storage or use of hazardous materials and located an approved distance from all structures.

**DETACHED SINGLE-FAMILY DWELLING.** *[HCD 1 & HCD 2] Any single-family dwelling which is separated (detached) from adjacent buildings.*

**DETAILED PLAIN CONCRETE STRUCTURAL WALL.** See Section 1905.1.1

**DETECTABLE WARNING.** *A standardized surface feature built in or applied to walking surfaces or other elements to warn of hazards on a circulation path.*

**[F] DETECTOR, HEAT.** A fire detector that senses heat—either abnormally high temperature or rate of rise, or both.

**DETENTION ELEVATOR [SFM].** *Detention elevator shall mean an elevator which moves in-custody individuals within a secure and restrained environment.*

**DETENTION TREATMENT ROOM. [SFM].** *Detention treatment room shall mean a lockable room or rooms within Group I-3 occupancies used for recreational therapy, group rooms, interdisciplinary treatment team rooms, and interview rooms not classified solely as a Group I-2 occupancy.*

**[F] DETONATION.** An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

**DETOXIFICATION FACILITIES.** Facilities that provide treatment for substance abuse, serving care recipients who are

## DEFINITIONS

incapable of self-preservation or who are harmful to themselves or others.

**DIAPHRAGM.** A horizontal or sloped system acting to transmit lateral forces to the vertical-resisting elements. When the term “diaphragm” is used, it shall include horizontal bracing systems.

**Diaphragm, blocked.** In light-frame construction, a diaphragm in which all sheathing edges not occurring on a framing member are supported on and fastened to blocking.

**Diaphragm boundary.** In light-frame construction, a location where shear is transferred into or out of the diaphragm sheathing. Transfer is either to a boundary element or to another force-resisting element.

**Diaphragm chord.** A diaphragm boundary element perpendicular to the applied load that is assumed to take axial stresses due to the diaphragm moment.

**Diaphragm flexible.** A diaphragm is flexible for the purpose of distribution of story shear and torsional moment where so indicated in Section 12.3.1 of ASCE 7.

**Diaphragm, rigid.** [DSA-SS, DSA-SS/CC & OSHPD 1 & 4] A diaphragm is rigid for the purpose of distribution of story shear and torsional moment *where so indicated in Section 12.3.1 of ASCE 7.*

**Diaphragm, unblocked.** A diaphragm that has edge nailing at supporting members only. Blocking between supporting structural members at panel edges is not included. Diaphragm panels are field nailed to supporting members.

## DIMENSIONS.

**Nominal.** The specified dimension plus an allowance for the joints with which the units are to be laid. Nominal dimensions are usually stated in whole numbers. Thickness is given first, followed by height and then length.

**Specified.** Dimensions specified for the manufacture or construction of a unit, joint element.

**DIRECT ACCESS.** A path of travel from a space to an immediately adjacent space through an opening in the common wall between the two spaces.

**DIRECTIONAL SIGN.** [DSA-AC, HCD 1 & HCD 2] A publicly displayed notice which indicates by use of words or symbols a recommended direction or route of travel.

**DISABILITY** [DSA-AC] Disability is (1) a physical or mental impairment that limits one or more of the major life activities of an individual, (2) a record of such an impairment, or (3) being regarded as having such an impairment.

**[F] DISPENSING.** The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

**DOOR, BALANCED.** A door equipped with double-pivoted hardware so designed as to cause a semicounter balanced swing action when opening.

**DORMITORY.** A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the

same family group, under joint occupancy and single management, as in college dormitories or fraternity houses. [SFM] For Group I-3 occupancies “Dormitory” is an area occupied by no less than three inmates.

**DRAFTSTOP.** A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics.

**DRAG STRUT.** See “Collector.”

**DRAIN.** A fitting or fixture, usually at or near the bottom of a pool, through which water leaves the pool normally to the recirculation pump.

**DRILLED SHAFT.** A drilled shaft is a cast-in-place deep foundation element constructed by drilling a hole (with or without permanent casing) into soil or rock and filling it with fluid concrete.

**Socketed drilled shaft.** A socketed drilled shaft is a drilled shaft with a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock.

**[F] DRY-CHEMICAL EXTINGUISHING AGENT.** A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

**DRY FLOODPROOFING.** A combination of design modifications that results in a building or structure, including the attendant utility and sanitary facilities, being water tight with walls substantially impermeable to the passage of water and with structural components having the capacity to resist loads as identified in ASCE 7.

**DURATION OF LOAD.** The period of continuous application of a given load, or the aggregate of periods of intermittent applications of the same load.

**DWELLING.** A building that contains one or two dwelling units used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

**DWELLING UNIT.** A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. [HCD 1-AC] For the purposes of Chapter 11A, a single unit of residence for a family of one or more persons. Examples of dwelling units covered by Chapter 11A include condominiums, an apartment unit within an apartment building, and other types of dwellings in which sleeping accommodations are provided but toileting or cooking facilities are shared by occupants of more than one room or portion of the dwelling. Examples of the latter include dormitory rooms and sleeping accommodations in shelters intended for occupancy as residences for homeless persons.

**DWELLING UNIT OR SLEEPING UNIT, MULTISTORY.** See definition for “Multistory unit.”

**EFFICIENCY DWELLING UNIT.** [HCD 1] A dwelling unit containing only one habitable room and includes an effi-

ciency unit as defined by Health and Safety Code Section 17958.1. See Section 1208.4.

**EFFECTIVE PARTICLE SIZE.** *The theoretical size of a sieve in mm that will pass 10 percent by weight of sand.*

**EGRESS COURT.** A court or yard which provides access to a public way for one or more exits.

**ELECTRIC VEHICLE.** See Section 406.7.

**ELEMENT.** [DSA-AC] *An architectural or mechanical component of a building, facility, space or site.*

**ELEVATED PLAY COMPONENT.** [DSA-AC] *A play component that is approached above or below grade and that is part of a composite play structure consisting of two or more play components attached or functionally linked to create an integrated unit providing more than one play activity.*

**ELEVATED STATION.** [SFM] *(See Chapter 4, Section 433 for definition of term.)*

**[F] ELEVATOR GROUP.** A grouping of elevators in a building located adjacent or directly across from one another that responds to common hall call buttons.

**ELEVATOR, PASSENGER.** [HCD 1 & HCD 2] See "PASSENGER ELEVATOR." [DSA-AC] *An elevator used primarily to carry passengers.*

**[F] EMERGENCY ALARM SYSTEM.** A system to provide indication and warning of emergency situations involving hazardous materials.

**[F] EMERGENCY CONTROL STATION.** An approved location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

**EMERGENCY ESCAPE AND RESCUE OPENING.** An operable window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

**EMERGENCY MANAGEMENT PANEL (EMP).** [SFM] *(See Chapter 4, Section 433 for definition of term.)*

**[F] EMERGENCY VOICE/ALARM COMMUNICATIONS.** Dedicated manual or automatic facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.

**EMPLOYEE WORK AREA.** All or any portion of a space used only by employees and only for work. Corridors, toilet rooms, kitchenettes and break rooms are not employee work areas.

**ENCLOSED STATION.** [SFM] *(See Chapter 4, Section 433 for definition of term.)*

**ENFORCEMENT.** [HCD 1 & HCD 2] *The applicable section of the Health and Safety Code is repeated here for clarity and reads as follows:*

*Section 17920. "Enforcement" means diligent effort to secure compliance, including review of plans and permit applications, response to complaints, citation of violations, and other legal process. Except as otherwise pro-*

*vided in this part, "enforcement" may, but need not, include inspections of existing buildings on which no complaint or permit application has been filed, and effort to secure compliance as to these existing buildings.*

**ENFORCEMENT AGENT.** [DSA-SS, DSA-SS/CC & OSHPD 1 & 4] *That individual within the agency or organization charged with responsibility for agency or organization compliance with the requirements of this Code. Used interchangeably with Building Official and Code Official.*

**ENFORCING AGENCY.** (DSA-AC, HCD 1 & HCD 2) *Enforcing Agency is the designated department or agency as specified by statute or regulation.*

**ENGINEERING ANALYSIS (FIRE HAZARD/FIRE RISK ASSESSMENT).** [SFM] *(See Chapter 4, Section 433 for definition of term.)*

**ENTRANCE.** *Any access point to a building or portion of a building or facility used for the purpose of entering. An entrance includes the approach walk, the vertical access leading to the entrance platform, the entrance platform itself, vestibule if provided, the entry door or gate, and the hardware of the entry door or gate.*

**ENTRANCE, PUBLIC.** See "Public entrance."

**ENTRANCE, RESTRICTED.** See "Restricted entrance."

**ENTRANCE, SERVICE.** See "Service entrance."

**EQUIPMENT PLATFORM.** An unoccupied, elevated platform used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, stairs, alternating tread devices and ladders necessary to access the platform (see Section 505.3).

**EQUIPMENT AREA.** *An area used for pool recirculation and purification equipment and related piping appurtenances.*

**EQUIVALENT FACILITATION.** *The use of designs, products or technologies as alternatives to those prescribed, resulting in substantially equivalent or greater accessibility and usability.*

*Note: In determining equivalent facilitation, consideration shall be given to means that provide for the maximum independence of persons with disabilities while presenting the least risk of harm, injury or other hazard to such persons or others.*

**ESSENTIAL FACILITIES.** Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes

**[F] EXHAUSTED ENCLOSURE.** An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.

## DEFINITIONS

**EXISTING BUILDING OR FACILITY.** [DSA-AC] A facility in existence on any given date, without regard to whether the facility may also be considered newly constructed or altered under this code.

**EXISTING CONSTRUCTION.** Any buildings and structures for which the start of construction commenced before the effective date of the community's first flood plain management code, ordinance or standard. "Existing construction" is also referred to as "existing structures."

**EXISTING STRUCTURE (For Section 1612.2).** See "Existing construction".

**EXISTING STRUCTURE (For Chapter 34).** A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

**EXIT.** That portion of a means of egress system between the exit access and the exit discharge or public way. Exit components include exterior exit doors at the level of exit discharge, interior exit stairways, interior exit ramps, exit passageways, exterior exit stairways and exterior exit ramps and horizontal exits.

**EXIT ACCESS.** That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

**EXIT ACCESS DOORWAY.** A door or access point along the path of egress travel from an occupied room, area or space where the path of egress enters an intervening room, corridor, exit access stair or exit access ramp.

**EXIT ACCESS RAMP.** An interior ramp that is not a required interior exit ramp.

**EXIT ACCESS STAIRWAY.** An interior stairway that is not a required interior exit stairway.

**EXIT DISCHARGE.** That portion of a means of egress system between the termination of an exit and a public way.

**EXIT DISCHARGE, LEVEL OF.** The story at the point at which an exit terminates and an exit discharge begins.

**EXIT HARDWARE, FIRE.** See "Fire exit hardware."

**EXIT, HORIZONTAL.** A path of egress travel from one building to an area in another building on approximately the same level, or a path of egress travel through or around a wall or partition to an area on approximately the same level in the same building, which affords safety from fire and smoke from the area of incidence and areas communicating therewith.

**EXIT PASSAGEWAY.** An exit component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to an exit or to the exit discharge.

**EXPANDED VINYL WALL COVERING.** Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells.

The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm).

**[F] EXPLOSION.** An effect produced by the sudden violent expansion of gases, which may be accompanied by a shock wave or disruption, or both, of enclosing materials or structures. An explosion could result from any of the following:

1. Chemical changes such as rapid oxidation, deflagration or detonation, decomposition of molecules and runaway polymerization (usually detonations).
2. Physical changes such as pressure tank ruptures.
3. Atomic changes (nuclear fission or fusion).

**[F] EXPLOSIVE.** A chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters and display fireworks, 1.3G.

The term "explosive" includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G by the hazardous materials regulations of DOTn 49 CFR Parts 100-185.

**High explosive.** Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

**Low explosive.** Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to, black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks, 1.3G and propellants, 1.3C.

**Mass-detonating explosives.** Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a considerable discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

**UN/DOTn Class 1 explosives.** The former classification system used by DOTn included the terms "high" and "low" explosives as defined herein. The following terms further define explosives under the current system applied by DOTn for all explosive materials defined as hazard Class 1 materials. Compatibility group letters are used in concert with the division to specify further limitations on each division noted (i.e., the letter G identifies the material as a pyrotechnic substance or article containing a pyrotechnic substance and similar materials).

**Division 1.1.** Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.

**Division 1.2.** Explosives that have a projection hazard but not a mass explosion hazard.

**Division 1.3.** Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

**Division 1.4.** Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

**Division 1.5.** Very insensitive explosives. This division is comprised of substances that have a mass explosion hazard, but that are so insensitive there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

**Division 1.6.** Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

**EXTERIOR COVERING. [SFM]** (See Chapter 7A, Section 702A for defined term.)

**EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS).** EIFS are nonstructural, nonload-bearing, exterior wall cladding systems that consist of an insulation board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat and a textured protective finish coat.

**EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE.** An EIFS that incorporates a means of drainage applied over a water-resistive barrier.

**EXTERIOR SURFACES.** Weather-exposed surfaces.

**EXTERIOR WALL.** A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

**EXTERIOR WALL COVERING.** A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

**EXTERIOR WALL ENVELOPE.** A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

**F RATING.** The time period that the through-penetration firestop system limits the spread of fire through the penetra-

tion when tested in accordance with ASTM E 814 or UL 1479.

**FABRIC PARTITION.** A partition consisting of a finished surface made of fabric, without a continuous rigid backing, that is directly attached to a framing system in which the vertical framing members are spaced greater than 4 feet (1219 mm) on center.

**FABRICATED ITEM.** Structural, load-bearing or lateral load-resisting assemblies consisting of materials assembled prior to installation in a building or structure, or subjected to operations such as heat treatment, thermal cutting, cold working or reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standard specifications referenced by this code, such as rolled structural steel shapes, steel reinforcing bars, masonry units and wood structural panels, or in accordance with a referenced standard which provides requirements for quality control done under the supervisions of a third-party quality control agency, shall not be considered "fabricated items."

**[F] FABRICATION AREA.** An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fabrication area processes.

**FACILITY.** All or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a site. *[DSA-AC] All or any portion of buildings, structures, site improvements, elements, and pedestrian routes or vehicular ways located on a site.*

**FACTORED LOAD.** The product of a nominal load and a load factor.

**FAMILY [HCD 1].** An individual or two or more persons who are related by blood or marriage; or otherwise live together in a dwelling unit.

**FIBER-CEMENT SIDING.** A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with discrete organic or inorganic nonasbestos fibers, or both. Additives that enhance manufacturing or product performance are permitted. Fiber-cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

**FIBER-REINFORCED POLYMER.** A polymeric composite material consisting of reinforcement fibers, such as glass, impregnated with a fiber-binding polymer which is then molded and hardened. Fiber-reinforced polymers are permitted to contain cores laminated between fiber-reinforced polymer facings.

**FIBERBOARD.** A fibrous, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot (pcf) (497 kg/m<sup>3</sup>) but more than 10 pcf (160 kg/m<sup>3</sup>).

**FIELD NAILING.** See "Nailing, field."

**[F] FIRE ALARM BOX, MANUAL.** See "Manual fire alarm box."

## DEFINITIONS

**[F] FIRE ALARM CONTROL UNIT.** A system component that receives inputs from automatic and manual fire alarm devices and may be capable of supplying power to detection devices and transponders or off-premises transmitters. The control unit may be capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.

**[F] FIRE ALARM SIGNAL.** A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, waterflow switch or other device whose activation is indicative of the presence of a fire or fire signature.

**[F] FIRE ALARM SYSTEM.** A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

***FIRE APPLIANCE. [SFM] The apparatus or equipment provided or installed for use in the event of an emergency.***

**FIRE AREA.** The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building. Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.

**FIRE BARRIER.** A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

**[F] FIRE COMMAND CENTER.** The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the systems can be manually controlled.

**FIRE DAMPER.** A listed device installed in ducts and air transfer openings designed to close automatically upon detection of heat and resist the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

**[F] FIRE DETECTOR, AUTOMATIC.** A device designed to detect the presence of a fire signature and to initiate action.

**FIRE DOOR.** The door component of a fire door assembly.

**FIRE DOOR ASSEMBLY.** Any combination of a fire door, frame, hardware and other accessories that together provide a specific degree of fire protection to the opening.

**FIRE DOOR ASSEMBLY, FLOOR.** See "Floor fire door assembly."

**FIRE EXIT HARDWARE.** Panic hardware that is listed for use on fire door assemblies.

***FIRE HAZARD SEVERITY ZONES. [SFM] (See Chapter 7A, Section 702A for defined term.)***

**[F] FIRE LANE.** A road or other passageway developed to allow the passage of fire apparatus. A fire lane is not necessarily intended for vehicular traffic other than fire apparatus.

**FIRE PARTITION.** A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

***FIRE PROTECTION PLAN. [SFM] (See Chapter 7A, Section 702A for defined term.)***

**FIRE PROTECTION RATING.** The period of time that an opening protective will maintain the ability to confine a fire as determined by tests prescribed in Section 715. Ratings are stated in hours or minutes.

**[F] FIRE PROTECTION SYSTEM.** Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

**FIRE-RATED GLAZING.** Glazing with either a fire protection rating or a fire-resistance rating.

**FIRE RESISTANCE.** That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

**FIRE-RESISTANCE RATING.** The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

**FIRE-RESISTANT JOINT SYSTEM.** An assemblage of specific materials or products that are designed, tested and fire-resistance rated in accordance with either ASTM E 1966 or UL 2079 to resist for a prescribed period of time the passage of fire through joints made in or between fire-resistance-rated assemblies.

**[F] FIRE SAFETY FUNCTIONS.** Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of harmful effects of fire.

**FIRE SEPARATION DISTANCE.** The distance measured from the building face to one of the following:

1. The closest interior lot line;
2. To the centerline of a street, an alley or public way; or
3. To an imaginary line between two buildings on the property.

The distance shall be measured at right angles from the face of the wall.

***FIRE-SMOKE BARRIER. [SFM] A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained in accordance with Section 707 and that is designed and constructed to restrict the movement of smoke in accordance with Section 710.***

***FIRE-RETARDANT TREATED WOOD. [SFM] See Section 2303.2.***

**FIRE WALL.** A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

**FIRE WINDOW ASSEMBLY.** A window constructed and glazed to give protection against the passage of fire.

**FIREBLOCKING.** Building materials, or materials approved for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

**FIREPLACE.** A hearth and fire chamber or similar prepared place in which a fire may be made and which is built in conjunction with a chimney.

**FIREPLACE THROAT.** The opening between the top of the firebox and the smoke chamber.

**FIRESTOP, MEMBRANE PENETRATION.** See “Membrane penetration firestop.”

**FIRESTOP, PENETRATION.** See “Penetration firestop.”

**FIRESTOP SYSTEM, THROUGH PENETRATION.** See “Through penetration firestop system.”

**[F] FIREWORKS.** Any composition or device for the purpose of producing a visible or audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.4G fireworks or 1.3G fireworks as set forth herein.

**Fireworks, 1.3G.** Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or detonation. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition, and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as fireworks, UN0335 by the DOTn.

**Fireworks, 1.4G.** Small fireworks devices containing restricted amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion. Such 1.4G fireworks which comply with the construction, chemical composition and labeling regulations of the DOTn for fireworks, UN0336, and the U.S. Consumer Product Safety Commission (CPSC) as set forth in CPSC 16 CFR: Parts 1500 and 1507, are not explosive materials for the purpose of this code.

**FIXED BASE OPERATOR (FBO).** A commercial business granted the right by the airport sponsor to operate on an airport and provide aeronautical services, such as fueling, hangaring, tie-down and parking, aircraft rental, aircraft maintenance and flight instruction.

**FIXED GUIDEWAY TRANSIT SYSTEM (the system).** [SFM] (See Chapter 4, Section 433 for definition of term.)

**FIXED SEATING.** Furniture or fixture designed and installed for the use of sitting and secured in place including bench-type seats and seats with or without backs or arm rests.

**FLAME SPREAD.** The propagation of flame over a surface.

**FLAME SPREAD INDEX.** A comparative measure, expressed as a dimensionless number, derived from visual

measurements of the spread of flame versus time for a material tested in accordance with ASTM E 84 or UL 723.

**[F] FLAMMABLE GAS.** A material that is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa)] which:

1. Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13 percent or less by volume with air; or
2. Has a flammable range at 14.7 psia (101 kPa) with air of at least 12 percent, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68°F (20°C) in accordance with ASTM E 681.

**[F] FLAMMABLE LIQUEFIED GAS.** A liquefied compressed gas which, under a charged pressure, is partially liquid at a temperature of 68°F (20°C) and which is flammable.

**[F] FLAMMABLE LIQUID.** A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

**Class IA.** Liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

**Class IB.** Liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).

**Class IC.** Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C). The category of flammable liquids does not include compressed gases or cryogenic fluids.

**[F] FLAMMABLE MATERIAL.** A material capable of being readily ignited from common sources of heat or at a temperature of 600°F (316°C) or less.

**[F] FLAMMABLE SOLID.** A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption or moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR; Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.1 inch (2.5 mm) per second along its major axis.

**[F] FLAMMABLE VAPORS OR FUMES.** The concentration of flammable constituents in air that exceed 25 percent of their lower flammable limit (LFL).

**[F] FLASH POINT.** The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D 56, ASTM D 93 or ASTM D 3278.

**FLIGHT.** A continuous run of rectangular treads, winders or combination thereof from one landing to another.

## DEFINITIONS

**FLOOD or FLOODING.** A general and temporary condition of partial or complete inundation of normally dry land from:

1. The overflow of inland or tidal waters.
2. The unusual and rapid accumulation or runoff of surface waters from any source.

**FLOOD DAMAGE-RESISTANT MATERIALS.** Any construction material capable of withstanding direct and prolonged contact with floodwaters without sustaining any damage that requires more than cosmetic repair.

**FLOOD, DESIGN.** See “Design flood.”

**FLOOD ELEVATION, DESIGN.** See “Design flood elevation.”

**FLOOD HAZARD AREA.** The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any year.
2. The area designated as a flood hazard area on a community’s flood hazard map, or otherwise legally designated.

**FLOOD HAZARD AREAS, SPECIAL.** See “Special flood hazard areas.”

**FLOOD HAZARD AREA SUBJECT TO HIGH-VELOCITY WAVE ACTION.** Area within the flood hazard area that is subject to high-velocity wave action, and shown on a Flood Insurance Rate Map (FIRM) or other flood hazard map as Zone V, VO, VE or V1-30.

**FLOOD INSURANCE RATE MAP (FIRM).** An official map of a community on which the Federal emergency Management Agency (FEMA) has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

**FLOOD INSURANCE STUDY.** The official report provided by the Federal Emergency Management Agency containing the Flood Insurance Rate Map (FIRM), the Flood Boundary and Floodway Map (FBFM), the water surface elevation of the base flood and supporting technical data.

**FLOODWAY.** The channel of the river, creek or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

**FLOOR AREA, GROSS.** The floor area within the inside perimeter of the exterior walls of the building under consideration, exclusive of vent shafts and courts, without deduction for corridors, stairways, closets, the thickness of interior walls, columns or other features. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above. The gross floor area shall not include shafts with no openings or interior courts.

**FLOOR AREA, NET.** The actual occupied area not including unoccupied accessory areas such as corridors, stairways, toilet rooms, mechanical rooms and closets.

**FLOOR FIRE DOOR ASSEMBLY.** A combination of a fire door, a frame, hardware and other accessories installed in a horizontal plane, which together provide a specific degree of fire protection to a through-opening in a fire-resistance-rated floor (see Section 711.8).

**[F] FOAM-EXTINGUISHING SYSTEM.** A special system discharging a foam made from concentrates, either mechanically or chemically, over the area to be protected.

**FOAM PLASTIC INSULATION.** A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (pcf) (320 kg/m<sup>3</sup>).

**FOLDING AND TELESCOPIC SEATING.** Tiered seating having an overall shape and size that is capable of being reduced for purposes of moving or storing and is not a building element.

**FOOD COURT.** A public seating area located in the mall that serves adjacent food preparation tenant spaces.

**FOSTER CARE FACILITIES.** See *FOSTER FAMILY HOME*.

***FOSTER FAMILY HOME.*** Any residential facility providing 24-hour care for six or fewer foster children that is owned, leased or rented and is the residence of the foster parent or parents, including their family, in whose care the foster children have been placed. The placement may be by a public or private child placement agency or by a court order, or by voluntary placement by a parent, parents or guardian. It also means a foster family home described in Section 1505.2.

**FOUNDATION PIER.** An isolated vertical foundation member whose horizontal dimension measured at right angles to its thickness does not exceed three times its thickness and whose height is equal to or less than four times its thickness.

**FRAME STRUCTURE.** A building or other structure in which vertical loads from floors and roofs are primarily supported by columns.

***FULL-TIME CARE.*** Shall mean the establishment and routine care of persons on an hourly, daily, weekly, monthly, yearly or permanent basis, whether for 24-hours per day or less, and where sleeping accommodations are provided.

***FUNCTIONAL AREA. [DSA-AC]*** A room, space or area intended or designated for a group of related activities or processes.

***GANGWAY. [DSA-AC]*** A variable-sloped pedestrian walkway that links a fixed structure or land with a floating structure. Gangways that connect to vessels are not addressed by this code.

**[F] GAS CABINET.** A fully enclosed, ventilated noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.



**[F] GAS ROOM.** A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

**[F] GASEOUS HYDROGEN SYSTEM.** An assembly of piping, devices and apparatus designed to generate, store, contain, distribute or transport a nontoxic, gaseous hydrogen-containing mixture having at least 95-percent hydrogen gas by volume and not more than 1-percent oxygen by volume. Gaseous hydrogen systems consist of items such as compressed gas containers, reactors and appurtenances, including pressure regulators, pressure relief devices, manifolds, pumps, compressors and interconnecting piping and tubing and controls.

**GLASS FIBERBOARD.** Fibrous glass roof insulation consisting of inorganic glass fibers formed into rigid boards using a binder. The board has a top surface faced with asphalt and kraft reinforced with glass fiber.

**GLUED BUILT-UP MEMBER.** A structural element, the section of which is composed of built-up lumber, wood structural panels or wood structural panels in combination with lumber, all parts bonded together with structural adhesives.

**GOLF CAR PASSAGE. [DSA-AC]** A continuous passage on which a motorized golf car can operate.

**GRAB BAR. [DSA-AC & HCD 1-AC]** A bar for the purpose of being grasped by the hand for support.

**GRADE (Adjacent Ground Elevation) [DSA-AC & HCD 1-AC]** The lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than 5 feet (1524 mm) from the building, between the building and a line 5 feet (1524 mm) from the building. See Health and Safety Code Section 19955.3(d).

**GRADE BREAK. [DSA-AC]** The line where two surface planes with different slopes meet.

**GROUND FLOOR. [DSA-AC]** The floor of a building with a building entrance on an accessible route. A building may have one or more ground floors.

**GROUND LEVEL PLAY COMPONENT. [DSA-AC]** A play component that is approached and exited at the ground level.

**GRADE FLOOR OPENING.** A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

**GRADE (LUMBER).** The classification of lumber in regard to strength and utility in accordance with American Softwood Lumber Standard DOC PS 20 and the grading rules of an approved lumber rules-writing agency.

**GRADE PLANE.** A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

**GRADE PLANE, STORY ABOVE.** See “Story above grade plane.”

**GRANDSTAND.** Tiered seating supported on a dedicated structural system and two or more rows high and is not a building element (see “Bleachers”).

**GROSS LEASABLE AREA.** The total floor area designed for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including areas used for storage, shall be included in calculating gross leasable area.

**GROUND FLOOR.** The floor of a building with a building entrance on an accessible route. A building may have one or more ground floors.

**GROUP HOME.** A facility that provides 24-hour care and supervision to children, provides services specified in this chapter to a specific client group, and maintains a structured environment, with such services provided at least in part by staff employed by the licensee. The care and supervision provided by a group home shall be nonmedical except as permitted by Welfare and Institutions Code Section 17736(b). Since small-family and foster family homes, by definition, care for six or fewer children only, any facility providing 24-hour care for seven or more children must be licensed as a group home.

**GUARD [DSA-AC, HCD 1 & HCD 2] OR GUARDRAIL.** A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.

**GUIDEWAY. [SFM]** (See Chapter 4, Section 433 for definition of term.)

**GYPSON BOARD.** Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, predecorated gypsum board or water-resistant gypsum backing board complying with the standards listed in Tables 2506.2, 2507.2 and Chapter 35.

**GYPSON PLASTER.** A mixture of calcined gypsum or calcined gypsum and lime and aggregate and other approved materials as specified in this code.

**GYPSON VENEER PLASTER.** Gypsum plaster applied to an approved base in one or more coats normally not exceeding  $\frac{1}{4}$  inch (6.4 mm) in total thickness.

**HABITABLE SPACE.** A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

**[F] HALOGENATED EXTINGUISHING SYSTEM.** A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

**[F] HANDLING.** The deliberate transport by any means to a point of storage or use.

**HANDRAIL.** A horizontal or sloping rail intended for grasping by the hand for guidance or support.

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**HANDWASHING FIXTURE.** Refer to the California Plumbing Code, Section 210.0.

**HARDBOARD.** A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 pcf (497 kg/m<sup>3</sup>).

**[F] HAZARDOUS MATERIALS.** Those chemicals or substances that are physical hazards or health hazards as classified in Section 307 and the California Fire Code, whether the materials are in usable or waste condition.

**[F] HAZARDOUS PRODUCTION MATERIAL (HPM).** A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or instability of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes which have as their end product materials that are not hazardous.

**HAZARDOUS SUBSTANCE.** [SFM] Hazardous Substance is a substance which, by reason of being explosive, flammable, toxic, poisonous, corrosive, oxidizing, irritant or otherwise harmful, is likely to cause injury.

**HEAD JOINT.** Vertical mortar joint placed between masonry units within the wythe at the time the masonry units are laid.

**HEALTH CARE PROVIDER.** [DSA-AC] See “Professional Office of a Health Care Provider”

**[F] HEALTH HAZARD.** A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term “health hazard” includes chemicals that are toxic or highly toxic, and corrosive.

**HEAT DETECTOR.** See “Detector, heat.”

**HEAVY TIMBER.** [SFM] (See Chapter 7A, Section 702A for defined term.)

**HEIGHT, BUILDING.** The vertical distance from grade plane to the average height of the highest roof surface.

**HELICAL PILE.** Manufactured steel deep foundation element consisting of a central shaft and one or more helical bearing plates. A helical pile is installed by rotating it into the ground. Each helical bearing plate is formed into a screw thread with a uniform defined pitch.

**HELIPAD.** A structural surface that is used for the landing, taking off, taxiing and parking of helicopters.

**HELIPORT.** An area of land or water or a structural surface that is used, or intended for the use, for the landing and taking off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings or other heliport facilities.

**HELISTOP.** The same as “heliport,” except that no fueling, defueling, maintenance, repairs or storage of helicopters is permitted.

**HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL).** Panels consisting of layers of cellulose fibrous material impregnated with thermosetting

resins and bonded together by a high-pressure process to form a homogeneous nonporous core suitable for exterior use.

**HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL) SYSTEM.** An exterior wall covering fabricated using HPL in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

**HIGH-RISE BUILDING.** In other than Group I-2 occupancies “high-rise buildings” as used in this code:

*Existing high-rise structure.* A high-rise structure, the construction of which is commenced or completed prior to July 1, 1974.

*High-rise structure.* Every building of any type of construction or occupancy having floors used for human occupancy located more than 75 feet above the lowest floor level having building access (see Section 403.1.2), except buildings used as hospitals as defined in Health and Safety Code Section 1250.

*New High-rise Building.* A high-rise structure, the construction of which is commenced on or after July 1, 1974. For the purpose of this section, construction shall be deemed to have commenced when plans and specifications are more than 50 percent complete and have been presented to the local jurisdiction prior to July 1, 1974. Unless all provisions of this section have been met, the construction of such buildings shall commence on or before January 1, 1976.

*New high-rise structure.* A high-rise structure, the construction of which is commenced on or after July 1, 1974.

**HIGH-RISE BUILDING ACCESS.** An exterior door opening conforming to all of the following:

1. Suitable and available for fire department use.
2. Located not more than 2 feet (610 mm) above the adjacent ground level.
3. Leading to a space, room or area having foot traffic communication capabilities with the remainder of the building.
4. Designed to permit penetration through the use of fire department forcible-entry tools and equipment unless other approved arrangements have been made with the fire authority having jurisdiction.

**[F] HIGHLY TOXIC.** A material which produces a lethal dose or lethal concentration that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD<sub>50</sub>) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD<sub>50</sub>) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3. A chemical that has a median lethal concentration ( $LC_{50}$ ) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

**HISTORIC BUILDINGS.** Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law (see Sections 3409 and 3411.9). *[DSA-AC] See "Qualified historical building or property," C.C.R., Title 24, Part 8.*

**HOLDING FACILITY.** *A detention or correctional facility or area where inmates, staff and public are not housed but are restrained.*

**HORIZONTAL ASSEMBLY.** A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

**HORIZONTAL EXIT.** See "Exit, horizontal."

**HOSPITALS AND PSYCHIATRIC HOSPITALS.** Facilities that provide care or treatment for the medical, psychiatric, obstetrical, or surgical treatment of care recipients that are incapable of self-preservation.

**HOTEL OR MOTEL.** *[HCD 1 & HCD 2] Any building containing six or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied, or which are occupied for sleeping purposes by guests.*

**HOUSING AT A PLACE OF EDUCATION.** *Housing operated by or on behalf of an elementary, secondary, undergraduate, or postgraduate school, or other place of education, including dormitories, suites, apartments, or other places of residence.*

**HOUSING UNIT.** *An area intended to lodge inmates on a 24-hour basis where accommodations are provided for sleeping.*

**[F] HPM FLAMMABLE LIQUID.** An HPM liquid that is defined as either a Class I flammable liquid or a Class II or Class IIIA combustible liquid.

**[F] HPM ROOM.** A room used in conjunction with or serving a Group H-5 occupancy, where HPM is stored or used and which is classified as a Group H-2, H-3 or H-4 occupancy.

**HURRICANE-PRONE REGIONS.** Areas vulnerable to hurricanes defined as:

1. The U. S. Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed,  $V_{ult}$ , for Risk Category buildings is greater than 115 mph (51.4 m/s); and
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

**[F] HYDROGEN CUTOFF ROOM.** A room or space that is intended exclusively to house a gaseous hydrogen system.

**ICE-SENSITIVE STRUCTURE.** A structure for which the effect of an atmospheric ice load governs the design of a structure or portion thereof. This includes, but is not limited to, lattice structures, guyed masts, overhead lines, light suspension and cable-stayed bridges, aerial cable systems (e.g., for ski lifts or logging operations), amusement rides, open catwalks and platforms, flagpoles and signs.

**IF, IF . . . THEN.** *[DSA-AC] The terms "if" and "if . . . then" denotes a specification that applies only when the conditions described are present.*

**IGNITION-RESISTANT MATERIAL.** *[SFM] (See Chapter 7A, Section 702A for defined term.)*

**[F] IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH).** The concentration of air-borne contaminants which poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppmv/v) or milligrams per cubic meter ( $mg/m^3$ ). If adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source approved by the building official shall make such determination.

**IMPACT LOAD.** The load resulting from moving machinery, elevators, craneways, vehicles and other similar forces and kinetic loads, pressure and possible surcharge from fixed or moving loads.

**INCIDENTAL STRUCTURAL ALTERATIONS, ADDITIONS, OR REPAIRS.** *[OSHDP 1 & 4] Alterations, additions or repairs which would not reduce the story lateral shear force-resisting capacity by more than 5 percent or increase the story shear by more than 5 percent in any existing story.*

**INCAPABLE OF SELF-PRESERVATION.** Persons because of age, physical limitations, mental limitations, chemical dependency, or medical treatment who cannot respond as an individual to an emergency situation.

**[F] INCOMPATIBLE MATERIALS.** Materials that, when mixed, have the potential to react in a manner that generates heat, fumes, gases or byproducts which are hazardous to life or property.

**[F] INERT GAS.** A gas that is capable of reacting with other materials only under abnormal conditions such as high temperatures, pressures and similar extrinsic physical forces. Within the context of the code, inert gases do not exhibit either physical or health hazard properties as defined (other than acting as a simple asphyxiant) or hazard properties other than those of a compressed gas. Some of the more common inert gases include argon, helium, krypton, neon, nitrogen and xenon.

**INFANT.** *Any child who because of age only, is unable to walk and requires the aid of another person to evacuate the*

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*building. In no case shall the term “infant” mean a child 2 years of age or older.*

**[F] INITIATING DEVICE.** A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

**INLET.** *A fitting or fixture through which circulation water enters the pool.*

**INSPECTION CERTIFICATE.** An identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency (see Section 1703.5 and “Label,” “Manufacturer’s designation” and “Mark”).

**INTERIOR EXIT RAMP.** An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

**INTERIOR EXIT STAIRWAY.** An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

**INTERIOR FINISH.** Interior finish includes interior wall and ceiling finish and interior floor finish.

**INTERIOR FLOOR FINISH.** The exposed floor surfaces of buildings including coverings applied over a finished floor or stair, including risers.

**INTERIOR FLOOR-WALL BASE.** Interior floor finish trim used to provide a functional or decorative border at the intersection of walls and floors.

**INTERIOR SURFACES.** Surfaces other than weather exposed surfaces.

**INTERIOR WALL AND CEILING FINISH.** The exposed interior surfaces of buildings, including but not limited to: fixed or movable walls and partitions; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.

**INTERLAYMENT.** A layer of felt or nonbituminous saturated felt not less than 18 inches (457 mm) wide, shingled between each course of a wood-shake roof covering.

**INTERNATIONAL SYMBOL OF ACCESSIBILITY.** *The symbol adopted by Rehabilitation International’s 11th World Congress for the purpose of indicating that buildings and facilities are accessible to persons with disabilities.*

**INTUMESCENT FIRE-RESISTANT COATINGS.** Thin film liquid mixture applied to substrates by brush, roller, spray or trowel which expands into a protective foamed layer to provide fire-resistant protection of the substrates when exposed to flame or intense heat.

**JOINT.** The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.

**[A] JURISDICTION.** The governmental unit that has adopted this code under due legislative authority.

**KEY STATION.** *[DSA-AC] Certain rapid and light rail stations, and commuter rail stations, as defined under criteria established by the Department of Transportation in 49 CFR 37.47 and 49 CFR 37.51, respectively.*

**KICK PLATE.** *An abrasion-resistant plate affixed to the bottom portion of a door to prevent a trap condition and protect its surface.*

**KITCHEN OR KITCHENETTE.** *[DSA-AC] A room, space or area with equipment for the preparation and cooking of food.*

**L RATING.** The air leakage rating of a through penetration firestop system or a fire-resistant joint system when tested in accordance with UL 1479 or UL 2079, respectively.

**[A] LABEL.** An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency (see Section 1703.5 and “Inspection certificate,” “Manufacturer’s designation” and “Mark”).

**[A] LABELED.** Equipment, materials or products to which has been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose. *[HCD 1 & HCD 2] “Labeled” means equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, approved by the Department, that maintains a periodic inspection program of production of labeled products, installations, equipment, or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.*

**LABORATORY.** *[SFM] A room, building or area where the use and storage of hazardous materials are utilized for testing, analysis, instruction, research or developmental activities.*

**LABORATORY SUITE.** *[SFM] A laboratory suite is a space within a building or structure, which may include multiple laboratories, offices, storage, equipment rooms or similar support functions, where the aggregate quantities of hazardous materials stored and used do not exceed the quantities set forth in Table 443.7.3.1.*

**LADDER.** *A series of vertically separate treads or rungs either connected by vertical rail members or independently fastened to an adjacent vertical pool wall.*

**LAVATORY.** *A fixed bowl or basin with running water and drainpipe, as in a toilet or bathing facility, for washing or bathing purposes. (As differentiated from the definition of “Sink”.)*

**LEVEL AREA.** *[HCD 1-AC] A specified surface that does not have a slope in any direction exceeding  $\frac{1}{4}$  inch (6.4 mm) in 1 foot (305 mm) from the horizontal (2.083-percent gradient).*

**LEVEL OF EXIT DISCHARGE.** See “Exit discharge, level of.”

**LICENSING AGENCY.** *[OSHPD 1] (See Chapter 12, Section 1224.3 for defined term.)*

**LIFT, PLATFORM (WHEELCHAIR).** *[HCD 1-AC] See “Platform (Wheelchair) Lift”.*

**LIGHT-DIFFUSING SYSTEM.** Construction consisting in whole or in part of lenses, panels, grids or baffles made with light-transmitting plastics positioned below independently mounted electrical light sources, skylights or light-transmitting plastic roof panels. Lenses, panels, grids and baffles that are part of an electrical fixture shall not be considered as a light-diffusing system.

**LIGHT-FRAME CONSTRUCTION.** A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

**LIGHT-TRANSMITTING PLASTIC ROOF PANELS.** Structural plastic panels other than skylights that are fastened to structural members, or panels or sheathing and that are used as light-transmitting media in the plane of the roof.

**LIGHT-TRANSMITTING PLASTIC WALL PANELS.** Plastic materials that are fastened to structural members, or to structural panels or sheathing, and that are used as light-transmitting media in exterior walls.

**LIMIT STATE.** A condition beyond which a structure or member becomes unfit for service and is judged to be no longer useful for its intended function (serviceability limit state) or to be unsafe (strength limit state).

**[F] LIQUID.** A material that has a melting point that is equal to or less than 68°F (20°C) and a boiling point that is greater than 68°F (20°C) at 14.7 pounds per square inch absolute (psia) (101 kPa). When not otherwise identified, the term “liquid” includes both flammable and combustible liquids.

**[F] LIQUID STORAGE ROOM.** A room classified as a Group H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

**[F] LIQUID USE, DISPENSING AND MIXING ROOM.** A room in which Class I, II and IIIA flammable or combustible liquids are used, dispensed or mixed in open containers.

**[A] LISTED.** Equipment, materials, products or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

**[HCD 1 & HCD 2] “Listed”** means all products that appear in a list published by an approved testing or listing agency. For additional information, see Health and Safety Code Section 17920(h).

For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, “listed” shall also mean equipment or materials accepted by the state fire marshal as conforming to the provisions of the State Fire Marshal’s regulations and which are included in a list published by the State Fire Marshal.

**LISTING AGENCY.** *[HCD 1 & HCD 2] An agency approved by the department that is in the business of listing and labeling products, materials, equipment and installations tested by an approved testing agency, and that maintains a periodic inspection program on current production of listed products, equipment and installations, and that, at least annually, makes available a published report of these listings. For additional information, see Health and Safety Code Section 17920(i).*

**LIQUID TIGHT FLOOR.** *[SFM] A nonpermeable barrier capable of containing hazardous material liquids without degradation.*

**LIVE/WORK UNIT.** A dwelling unit or sleeping unit in which a significant portion of the space includes a nonresidential use that is operated by the tenant.

**LIVE LOAD.** A load produced by the use and occupancy of the building or other structure that does not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

**LIVE LOAD, ROOF.** A load on a roof produced:

1. During maintenance by workers, equipment and materials;
2. During the life of the structure by movable objects such as planters or other similar small decorative appurtenances that are not occupancy related; or
3. By the use and occupancy of the roof such as for roof gardens or assembly areas.

**LOAD AND RESISTANCE FACTOR DESIGN (LRFD).**

A method of proportioning structural members and their connections using load and resistance factors such that no applicable limit state is reached when the structure is subjected to appropriate load combinations. The term “LRFD” is used in the design of steel and wood structures.

**LOAD EFFECTS.** Forces and deformations produced in structural members by the applied loads.

**LOAD FACTOR.** A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the probability that more than one extreme load will occur simultaneously.

**LOADS.** Forces or other actions that result from the weight of building materials, occupants and their possessions, environmental effects, differential movement and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude,

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such as dead loads. All other loads are variable loads (see also “Nominal loads”).

**LOBBY.** [SFM, HCD 1 & HCD 2] *An area not defined as a waiting room at the entrance of a building through which persons must pass.*

**LOCAL AGENCY VERY HIGH FIRE HAZARD SEVERITY ZONE.** [SFM] *(See Chapter 7A, Section 702A for defined term.)*

**LODGING HOUSE.** [HCD 1] *Any building or portion thereof containing not more than five guest rooms where rent is paid in money, goods, labor or otherwise.*

**LOG WALL CONSTRUCTION.** [SFM] *(See Chapter 7A, Section 702A for defined term.)*

**[A] LOT.** A portion or parcel of land considered as a unit.

**[A] LOT LINE.** A line dividing one lot from another, or from a street or any public place.

**[F] LOWER FLAMMABLE LIMIT (LFL).** The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as “LEL” or “lower explosive limit.”

**LOWEST FLOOR.** The floor of the lowest enclosed area, including basement, but excluding any unfinished or flood-resistant enclosure, usable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the structure in violation of Section 1612.

**MAIL BOXES.** [DSA-AC] *Receptacles for the receipt of documents, packages or other deliverable matter. Mail boxes include, but are not limited to, post office boxes and receptacles provided by commercial mail-receiving agencies, apartment facilities or schools.*

**MAIN WINDFORCE-RESISTING SYSTEM.** An assemblage of structural elements assigned to provide support and stability for the overall structure. The system generally receives wind loading from more than one surface

**MAJOR STRUCTURAL ALTERATIONS, ADDITIONS, OR REPAIRS.** [OSHDP 1 & 4] *Alterations, additions or repairs of greater extent than incidental structural additions or alterations which would not reduce the story shear lateral-force-resisting capacity by more than 10 percent or increase base shear by more than 10 percent.*

**MALL BUILDING, COVERED and MALL BUILDING, OPEN.** See “Covered mall building.”

**[F] MANUAL FIRE ALARM BOX.** A manually operated device used to initiate an alarm signal.

**[A] MANUFACTURER’S DESIGNATION.** An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also “Inspection certificate,” “Label” and “Mark”).

**[A] MARK.** An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also “Inspection certificate,” “Label” and “Manufacturer’s designation”).

**MARKED CROSSING.** *A crosswalk or other identified path intended for pedestrian use in crossing a vehicular way.*

**MARQUEE.** A canopy that has a top surface which is sloped less than 25 degrees from the horizontal and is located less than 10 feet (3.05 m) from operable openings above or adjacent to the level of the marquee.

**MASONRY.** A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other approved units bonded together with or without mortar or grout or other accepted methods of joining.

**Ashlar masonry.** Masonry composed of various-sized rectangular units having sawed, dressed or squared bed surfaces, properly bonded and laid in mortar.

**Coursed ashlar.** Ashlar masonry laid in courses of stone of equal height for each course, although different courses shall be permitted to be of varying height.

**Glass unit masonry.** Masonry composed of glass units bonded by mortar.

**Plain masonry.** Masonry in which the tensile resistance of the masonry is taken into consideration and the effects of stresses in reinforcement are neglected.

**Random ashlar.** Ashlar masonry laid in courses of stone set without continuous joints and laid up without drawn patterns. When composed of material cut into modular heights, discontinuous but aligned horizontal joints are discernible.

**Reinforced masonry.** Masonry construction in which reinforcement acting in conjunction with the masonry is used to resist forces.

**Solid masonry.** Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

**Unreinforced (plain) masonry.** Masonry in which the tensile resistance of masonry is taken into consideration and the resistance of the reinforcing steel, if present, is neglected.

**MASONRY UNIT.** Brick, tile, stone, glass block or concrete block conforming to the requirements specified in Section 2103.

**Hollow.** A masonry unit whose net cross-sectional area in any plane parallel to the load-bearing surface is less than 75 percent of its gross cross-sectional area measured in the same plane.

**Solid.** A masonry unit whose net cross-sectional area in every plane parallel to the load-bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

**MASTIC FIRE-RESISTANT COATINGS.** Liquid mixture applied to a substrate by brush, roller, spray or trowel that provides fire-resistant protection of a substrate when exposed to flame or intense heat.

**MAY.** [DSA-AC] *May denotes an option or alternative.*

**MEANS OF EGRESS.** A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.

**MECHANICAL-ACCESS OPEN PARKING GARAGES.**

Open parking garages employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

**MECHANICAL EQUIPMENT SCREEN.** A rooftop structure, not covered by a roof, used to aesthetically conceal plumbing, electrical or mechanical equipment from view.

**MECHANICAL SYSTEMS.** For the purposes of determining seismic loads in ASCE 7, mechanical systems shall include plumbing systems as specified therein.

**MEDICAL CARE.** Care involving medical or surgical procedures, nursing or for psychiatric purposes.

**MEDICAL POOL.** *A special-purpose pool used by a state-recognized medical institution engaged in the healing arts under the direct supervision of licensed medical personnel for treatment of the infirm.*

**MEMBRANE-COVERED CABLE STRUCTURE.** A nonpressurized structure in which a mast and cable system provides support and tension to the membrane weather barrier and the membrane imparts stability to the structure.

**MEMBRANE-COVERED FRAME STRUCTURE.** A nonpressurized building wherein the structure is composed of a rigid framework to support a tensioned membrane which provides the weather barrier.

**MEMBRANE PENETRATION.** A breach in one side of a floor-ceiling, roof-ceiling or wall assembly to accommodate an item installed into or passing through the breach.

**MEMBRANE-PENETRATION FIRESTOP.** A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items.

**MEMBRANE-PENETRATION FIRESTOP SYSTEM.** An assemblage consisting of a fire-resistance-rated floor-ceiling, roof-ceiling or wall assembly, one or more penetrating items installed into or passing through the breach in one side of the assembly and the materials or devices, or both, installed to resist the spread of fire into the assembly for a prescribed period of time.

**MENTALLY RETARDED PERSONS, PROFOUNDLY OR SEVERELY.** *Shall mean any retarded person who is unable to evacuate a building unassisted during emergency conditions.*

*Note: The determination as to such incapacity shall be made by the Director of the State Department of Public Health or his or her designated representative pursuant to Health and Safety Code Section 13131.3.*

**MERCHANDISE PAD.** A merchandise pad is an area for display of merchandise surrounded by aisles, permanent fixtures or walls. Merchandise pads contain elements such as

nonfixed and moveable fixtures, cases, racks, counters and partitions as indicated in Section 105.2 from which customers browse or shop.

**METAL COMPOSITE MATERIAL (MCM).** A factory-manufactured panel consisting of metal skins bonded to both faces of a plastic core.

**METAL COMPOSITE MATERIAL (MCM) SYSTEM.** An exterior wall covering fabricated using MCM in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

**METAL ROOF PANEL.** An interlocking metal sheet having a minimum installed weather exposure of 3 square feet (0.279 m<sup>2</sup>) per sheet.

**METAL ROOF SHINGLE.** An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.279 m<sup>2</sup>) per sheet.

**MEZZANINE.** An intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505. *[DSA-AC] An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located. Mezzanines have sufficient elevation that space for human occupancy can be provided on the floor below.*

**MICROPILE.** A micropile is a bored, grouted-in-place deep foundation element that develops its load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock.

**MINERAL BOARD.** A rigid felted thermal insulation board consisting of either felted mineral fiber or cellular beads of expanded aggregate formed into flat rectangular units.

**MINERAL FIBER.** Insulation composed principally of fibers manufactured from rock, slag or glass, with or without binders.

**MINERAL WOOL.** Synthetic vitreous fiber insulation made by melting predominately igneous rock or furnace slag, and other inorganic materials, and then physically forming the melt into fibers.

**MINOR STRUCTURAL ALTERATIONS, ADDITIONS, OR REPAIRS.** *[OSHPD 1 & 4] Alterations, additions or repairs of greater extent than incidental structural additions or alterations which would not reduce the story shear lateral-force-resisting capacity by more than 10 percent or increase base shear by more than 10 percent.*

**MODIFIED BITUMEN ROOF COVERING.** One or more layers of polymer-modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

**MONOLITHIC.** *[OSHPD 1] (See Chapter 12, Section 1224.3 for defined term.)*

**MONOLITHIC CEILING.** *[OSHPD 1] (See Chapter 12, Section 1224.3 for defined term.)*

**MORTAR.** A mixture consisting of cementitious materials, fine aggregates, water, with or without admixtures, that is used to construct unit masonry assemblies.

## DEFINITIONS

**MORTAR, SURFACE-BONDING.** A mixture to bond concrete masonry units that contains hydraulic cement, glass fiber reinforcement with or without inorganic fillers or organic modifiers and water.

**MOTEL.** [HCD 1 & HCD 2] See “Hotel” or “Motel.”

**MOTION PICTURE AND TELEVISION PRODUCTION STUDIO SOUND STAGES, APPROVED PRODUCTION FACILITIES AND PRODUCTION LOCATIONS.** See Chapter 46, California Fire Code.

**[F] MULTIPLE-STATION ALARM DEVICE.** Two or more single-station alarm devices that can be interconnected such that actuation of one causes all integral or separate audible alarms to operate. It also can consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.

**[F] MULTIPLE-STATION SMOKE ALARM.** Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes the appropriate alarm signal to operate in all interconnected alarms.

**MULTISTORY DWELLING UNIT.** [HCD 1-AC] A dwelling unit with finished living space located on one floor and the floor or floors immediately above or below it.

**NAILING, BOUNDARY.** A special nailing pattern required by design at the boundaries of diaphragms.

**NAILING, EDGE.** A special nailing pattern required by design at the edges of each panel within the assembly of a diaphragm or shear wall.

**NAILING, FIELD.** Nailing required between the sheathing panels and framing members at locations other than boundary nailing and edge nailing.

**NATURALLY DURABLE WOOD.** The heartwood of the following species except for the occasional piece with corner sapwood, provided 90 percent or more of the width of each side on which it occurs is heartwood.

**Decay resistant.** Redwood, cedar, black locust and black walnut.

**Termite resistant.** Redwood, Alaska yellow cedar, Eastern red cedar and both heartwood and all sapwood of Western red cedar.

**NEWLY CONSTRUCTED.** [HCD 1-AC] A building that has never before been used or occupied for any purpose.

**NEXT GENERATION ATTENUATION (NGA).** [DSA-SS, DSA-SS/CC & OSHPD 1 & 4] Attenuation relations used for the 2008 United States Geological Survey (USGS) seismic hazards maps (for the Western United States) or their equivalent as determined by the enforcement agency.

**NFPA [DSA-AC]** The National Fire Protection Association.

**NOMINAL LOADS.** The magnitudes of the loads specified in Chapter 16 (dead, live, soil, wind, snow, rain, flood and earthquake).

**NOMINAL SIZE (LUMBER).** The commercial size designation of width and depth, in standard sawn lumber and glued-laminated lumber grades; somewhat larger than the standard net size of dressed lumber, in accordance with

DOCPS 20 for sawn lumber and with the AF&PA NDS for glued-laminated lumber.

**NONAMBULATORY PERSONS.** Persons unable to leave a building unassisted under emergency conditions. It includes, but is not limited to, persons who depend on mechanical aids such as crutches, walkers and wheelchairs and any person who is unable to physically and mentally respond to a sensory signal approved by the state fire marshal or an oral instruction relating to fire danger.

The determination of ambulatory or nonambulatory status of persons with developmental disabilities shall be made by the Director of Social Services or his or her designated representative, in consultation with the director of Developmental Services or his or her designated representative. The determination of ambulatory or nonambulatory status of all other disabled persons placed after January 1, 1984, who are not developmentally disabled shall be made by the Director of Social Services or his or her designated representative.

**NONCOMBUSTIBLE.** [SFM] Noncombustible as applied to building construction material means a material which, in the form in which it is used, is either one of the following:

1. Material of which no part will ignite and burn when subjected to fire. Any material passing ASTM E 136 shall be considered noncombustible.
2. Material having a structural base of noncombustible material as defined in Item 1 above, with a surfacing material not over 1/8 inch (3.2 mm) thick which has a flame-spread index of 50 or less.

“Noncombustible” does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item 1. No material shall be classed as noncombustible which is subject to increase in combustibility or flame-spread index, beyond the limits herein established, through the effects of age, moisture or other atmospheric condition.

**NONCOMBUSTIBLE MEMBRANE STRUCTURE.** A membrane structure in which the membrane and all component parts of the structure are noncombustible.

**NORMAL.** [HCD 1 & HCD 2] Conforming to a pattern or standard regarded as usual or typical.

**[F] NORMAL TEMPERATURE AND PRESSURE (NTP).** A temperature of 70°F (21°C) and a pressure of 1 atmosphere [14.7 psia (101 kPa)].

**NOSING.** The leading edge of treads of stairs and of landings at the top of stairway flights.

**[F] NOTIFICATION ZONE.** See “Zone, notification.”

**NPC 1, NPC 2, NPC 3/NPC 3R, NPC 4, and NPC 5** are the building nonstructural performance categories for Hospital Buildings defined in Table 11.1 of California Administrative Code (Part 1, Title 24 CCR), Chapter 6.

**[F] NUISANCE ALARM.** An alarm caused by mechanical failure, malfunction, improper installation or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.



**NURSING HOMES.** Facilities that provide care, including both intermediate care facilities and skilled nursing facilities where any of the persons are incapable of self-preservation or *classified as nonambulatory or bedridden.*

**OCCUPANT LOAD.** The number of persons for which the means of egress of a building or portion thereof is designed.

**OCCUPIABLE SPACE.** A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with means of egress and light and ventilation facilities meeting the requirements of this code.

**OPEN PARKING GARAGE.** A structure or portion of a structure with the openings as described in Section 406.5.2 on two or more sides that is used for the parking or storage of private motor vehicles as described in Section 406.5.3.

**OPEN RISER.** *The space between two adjacent stair treads not closed by a riser.*

**OPEN STATION.** [SFM] (See Chapter 4, Section 433 for definition of term.)

**[F] OPEN SYSTEM.** The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples of open systems for solids and liquids include dispensing from or into open beakers or containers, dip tank and plating tank operations.

**OPERATIONS CONTROL CENTER (OCC) (CENTRAL CONTROL).** [SFM] (See Chapter 4, Section 433 for definition of term)

**OPERABLE PART.** *A component of an element used to insert or withdraw objects, or to activate, deactivate, or adjust the element.*

**[F] OPERATING BUILDING.** A building occupied in conjunction with the manufacture, transportation or use of explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances

**ORDINARY PRECAST STRUCTURAL WALL.** See Section 1905.1.1.

**ORDINARY REINFORCED CONCRETE STRUCTURAL WALL.** See Section 1905.1.1.

**ORDINARY STRUCTURAL PLAIN CONCRETE WALL.** See Section 1905.1.1.

**[F] ORGANIC PEROXIDE.** An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can pose an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

**Class I.** Those formulations that are capable of deflagration but not detonation.

**Class II.** Those formulations that burn very rapidly and that pose a moderate reactivity hazard.

**Class III.** Those formulations that burn rapidly and that pose a moderate reactivity hazard.

**Class IV.** Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

**Class V.** Those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

**Unclassified detonable.** Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition.

**ORGANIZED CAMPS.** See Section 440.

**ORTHOGONAL.** To be in two horizontal directions, at 90 degrees (1.57 rad) to each other.

**OTHER STRUCTURES.** Structures, other than buildings, for which loads are specified in Chapter 16.

**OUTPATIENT CLINIC.** See "Clinic, outpatient."

**[A] OWNER.** Any person, agent, firm or corporation having a legal or equitable interest in the property.

**OVERFLOW SYSTEM.** *The system which includes perimeter-type overflow gutters, surface skimmers, surge or collector tanks, other surface water collective system components and their interconnecting piping.*

**[F] OXIDIZER.** A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and, if heated or contaminated, can result in vigorous self-sustained decomposition.

**Class 4.** An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Additionally, the oxidizer causes a severe increase in the burning rate and can cause spontaneous ignition of combustibles.

**Class 3.** An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes in contact.

**Class 2.** An oxidizer that will cause a moderate increase in the burning rate of combustible materials with which it comes in contact.

**Class 1.** An oxidizer that does not moderately increase the burning rate of combustible materials.

**[F] OXIDIZING GAS.** A gas that can support and accelerate combustion of other materials more than air does.

**PANEL (PART OF A STRUCTURE).** The section of a floor, wall or roof comprised between the supporting frame of two adjacent rows of columns and girders or column bands of floor or roof construction.

**PANIC HARDWARE.** A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel. See also "Fire exit hardware."

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**PARTICLEBOARD.** A generic term for a panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers. The cellulosic material is combined with synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

**PASSAGE DOOR.** [HCD 1-AC] A door other than an exit door through which persons may traverse.

**PASSENGER ELEVATOR.** [DSA-AC] See “Elevator, Passenger”

[HCD 1 & HCD 2] “Passenger Elevator” is an elevator used primarily to carry persons. For additional information, see California Code of Regulations, Title 8, Division 1, Chapter 4.

**PASSIVE SOLAR ENERGY COLLECTOR.** [HCD 1 & HCD 2] Uses architectural components, rather than mechanical components, to provide heating or cooling for a building interior.

**PATH OF TRAVEL.** [DSA-AC] An identifiable accessible route within an existing site, building or facility by means of which a particular area may be approached, entered and exited, and which connects a particular area with an exterior approach (including sidewalks, streets and parking areas), an entrance to the facility, and other parts of the facility. When alterations, structural repairs or additions are made to existing buildings or facilities, the term “path of travel” also includes the toilet and bathing facilities, telephones, drinking fountains and signs serving the area of work.

**PEDESTRIAN.** An individual who moves in walking areas with or without the use of walking assistive devices such as crutches, leg braces, wheelchairs, white cane, service animal, etc.

**PEDESTRIAN WAY.** A route by which a pedestrian may pass.

**PENETRATION FIRESTOP.** A through-penetration firestop or a membrane-penetration firestop.

**PENTHOUSE.** An enclosed, unoccupied rooftop structure used for sheltering mechanical and electrical equipment, tanks, elevators and related machinery, and vertical shaft openings.

**PERFORMANCE CATEGORY.** A designation of wood structural panels as related to the panel performance used in Chapter 23.

**PERMANENT** [DSA-AC] Facilities which, are intended to be used for periods longer than those designated in this code under the definition of “Temporary.”

**PERMANENT PORTABLE BUILDING.** [SFM] A portable building that is used to serve or house students and is certified as a permanent building on a new public school campus by the public school administration shall comply with the requirements of new campus buildings.

**[A] PERMIT.** An official document or certificate issued by the authority having jurisdiction which authorizes performance of a specified activity.

**[A] PERSON.** An individual, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

**PERSONS WITH DISABILITIES.**[HCD 1-AC] For purposes of Chapter 11A, “Persons with disabilities” includes, but is not limited to, any physical or mental disability as defined in Government Code Section 12926.

**PICTOGRAM.** A pictorial symbol that represents activities, facilities, or concepts.

**PHOTOLUMINESCENT.** Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed.

**PHOTOVOLTAIC MODULES/SHINGLES.** A roof covering composed of flat-plate photovoltaic modules fabricated in sheets that resemble three-tab composite shingles.

**[F] PHYSICAL HAZARD.** A chemical for which there is evidence that it is a combustible liquid, cryogenic fluid, explosive, flammable (solid, liquid or gas), organic peroxide (solid or liquid), oxidizer (solid or liquid), oxidizing gas, pyrophoric (solid, liquid or gas), unstable (reactive) material (solid, liquid or gas) or water-reactive material (solid or liquid).

**[F] PHYSIOLOGICAL WARNING THRESHOLD LEVEL.** A concentration of air-borne contaminants, normally expressed in parts per million (ppm) or milligrams per cubic meter (mg/m<sup>3</sup>), that represents the concentration at which persons can sense the presence of the contaminant due to odor, irritation or other quick-acting physiological response. When used in conjunction with the permissible exposure limit (PEL) the physiological warning threshold levels are those consistent with the classification system used to establish the PEL. See the definition of “Permissible exposure limit (PEL)” in the California Fire Code.

**PLACE OF PUBLIC ACCOMMODATION.** A facility operated by a private entity whose operations affect commerce and fall within at least one of the following categories:

- (1) Place of lodging, except for an establishment located within a facility that contains not more than five rooms for rent or hire and that actually is occupied by the proprietor of the establishment as the residence of the proprietor. For purposes of this code, a facility is a “place of lodging” if it is
  - (i) An inn, hotel or motel; or
  - (ii) A facility that
    - (A) Provides guest rooms for sleeping for stays that primarily are short-term in nature (generally 30 days or less) where the occupant does not have the right to return to a specific room or unit after the conclusion of his or her stay; and
    - (B) Provides guest rooms under conditions and with amenities similar to a hotel, motel, or inn, including the following:
      - (1) On- or off-site management and reservations service;

- (2) *Rooms available on a walk-up or call-in basis;*
- (3) *Availability of housekeeping or linen service; and*
- (4) *Acceptance of reservations for a guest room type without guaranteeing a particular unit or room until check-in, and without a prior lease or security deposit.*
- (2) *A restaurant, bar, or other establishment serving food or drink;*
- (3) *A motion picture house, theater, concert hall, stadium, or other place of exhibition or entertainment;*
- (4) *An auditorium, convention center, lecture hall, or other place of public gathering;*
- (5) *A bakery, grocery store, clothing store, hardware store, shopping center, or other sales or rental establishment;*
- (6) *A laundromat, dry-cleaner, bank, barber shop, beauty shop, travel service, shoe repair service, funeral parlor, gas station, office of an accountant or lawyer, pharmacy, insurance office, professional office of a health care provider, hospital, or other service establishment;*
- (7) *A terminal, depot, or other station used for specified public transportation;*
- (8) *A museum, library, gallery, or other place of public display or collection;*
- (9) *A park, zoo, amusement park, or other place of recreation;*
- (10) *A nursery, elementary, secondary, undergraduate, or postgraduate private school, or other place of education;*
- (11) *A day-care center, senior citizen center, homeless shelter, food bank, adoption agency, or other social service center establishment;*
- (12) *A gymnasium, health spa, bowling alley, golf course, or other place of exercise or recreation;*
- (13) *A religious facility;*
- (14) *An office building; and*
- (15) *A public curb or sidewalk.*

**PLACE OF RELIGIOUS WORSHIP.** See “Religious worship, place of.”

**PLASTIC, APPROVED.** Any thermoplastic, thermosetting or reinforced thermosetting plastic material that conforms to combustibility classifications specified in the section applicable to the application and plastic type.

**PLASTIC GLAZING.** Plastic materials that are glazed or set in frame or sash and not held by mechanical fasteners that pass through the glazing material.

**PLATFORM.** A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers

and speakers; boxing and wrestling rings; theater-in-the-round stages; and similar purposes wherein there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.

**PLATFORM (WHEELCHAIR) LIFT.** A hoisting and lowering mechanism equipped with a car or platform or support that serves two landings of a building or structure and is designed to carry a passenger or passengers and/or luggage or other material a vertical distance as may be allowed.

**PLAY AREA. [DSA-AC]** A portion of a site containing play components designed and constructed for children.

**PLAY COMPONENT. [DSA-AC]** An element intended to generate specific opportunities for play, socialization or learning. Play components are manufactured or natural; and are stand-alone or part of a composite play structure.

**POINT OF SAFETY. [SFM]** (See Chapter 4, Section 433 for definition of term.)

**POINT-OF-SALE DEVICE. [DSA-AC]** A device used for the purchase of a good or service where a personal identification number (PIN), zip code or signature is required.

**POLYPROPYLENE SIDING.** A shaped material, made principally from polypropylene homopolymer, or copolymer, which in some cases contains fillers or reinforcements, that is used to clad exterior walls of buildings.

**POOL.** A constructed or prefabricated artificial basin, chamber or tank intended to be used primarily by bathers, and not for cleaning of the body or for individual therapeutic use.

**POOL USER.** A person using a pool and ancillary facilities for the purpose of water activities such as diving, swimming or wading.

**POOL VOLUME.** The amount of water expressed in gallons (liters) that a pool holds when filled.

**PORCELAIN TILE.** Porcelain tile shall conform to the requirements of ANSI 137.1.3 for ceramic tile having an absorption of 0.5 percent or less according to ANSI 137.4.1–Class Table and ANSI 137.1.6.1 Allowable Properties by Tile Type–Table 10.

**POSITIVE ROOF DRAINAGE.** The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

**POWDER ROOM.** A room containing a water closet (toilet) and a lavatory, and which is not defined as a bathroom.

**POWER-ASSISTED DOOR [DSA-AC]** A door used for human passage with a mechanism that helps to open the door, or relieves the opening resistance of a door, upon the activation of a switch or a continued force applied to the door itself.

**POWER SUBSTATION. [SFM]** (See Chapter 4, Section 433 for definition of term.)

**PREFABRICATED WOOD I-JOIST.** Structural member manufactured using sawn or structural composite lumber flanges and wood structural panel webs bonded together with

## DEFINITIONS

exterior exposure adhesives, which forms an “I” cross-sectional shape.

**PRESTRESSED MASONRY.** Masonry in which internal stresses have been introduced to counteract potential tensile stresses in masonry resulting from applied loads.

**PRIMARY ENTRY.** [HCD 1-AC] *The principal entrance through which most people enter the building, as designated by the building official.*

**PRIMARY ENTRY LEVEL.** [HCD 1-AC] *The floor or level of the building on which the primary entry is located.*

**PRIMARY FUNCTION.** A primary function is a major activity for which the facility is intended. Areas that contain a primary function include, but are not limited to, the customer service lobby of a bank, the dining area of a cafeteria, the meeting rooms in a conference center, as well as offices and other work areas in which the activities of the public accommodation or other private entity using the facility are carried out. Mechanical rooms, boiler rooms, supply storage rooms, employee lounges or locker rooms, janitorial closets, entrances, corridors and restrooms are not areas containing a primary function.

**PRIMARY STRUCTURAL FRAME.** The primary structural frame shall include all of the following structural members:

1. The columns;
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels;
3. Members of the floor construction and roof construction having direct connections to the columns; and
4. Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading shall be considered part of the primary structural frame whether or not the bracing member carries gravity loads.

**PRISM.** An assemblage of masonry units and mortar with or without grout used as a test specimen for determining properties of the masonry.

**PRIVATE BUILDING OR FACILITY.** [DSA-AC] *A place of public accommodation or a commercial building or facility subject to Chapter 1, Section 1.9.1.2.*

**PRIVATE POOL.** Any constructed pool, permanent or portable, that is intended for noncommercial use as a swimming pool by not more than three owner families and their guests.

**Note:** A single-family residence is a Group R, Division 3 occupancy.

**PROFESSIONAL OFFICE OF A HEALTH CARE PROVIDER.** [DSA-AC] *See Chapter 11B. A location where a person or entity, regulated by the State to provide professional services related to the physical or mental health of an individual, makes such services available to the public. The facility housing the professional office of a health care provider only includes floor levels housing at least one health care provider, or any floor level designed or intended for use by at least one health care provider.*

**PROSCENIUM WALL.** The wall that separates the stage from the auditorium or assembly seating area.

**PROTECTIVE SOCIAL CARE FACILITY.** [SFM] *A facility housing persons, who are referred, placed or caused to be placed in the facility, by any governmental agency and for whom the services, or a portion thereof, are paid for by any governmental agency. These occupancies shall include, but are not limited to, those commonly referred to as “assisted living facilities,” “social rehabilitation facilities,” “certified family care homes,” “out-of-home placement facilities,” and “halfway houses.”*

**PSYCHIATRIC HOSPITALS.** See “Hospitals.”

**PUBLIC BUILDING OR FACILITY.** [DSA-AC] *A building or facility or portion of a building or facility designed, constructed, or altered by, on behalf of, or for the use of a public entity subject to Chapter 1, Section 1.9.1.1.*

**PUBLIC ENTITY.** Any state or local government; any department, agency, special-purpose district, or other instrumentality of a state or local government.

**PUBLIC ENTRANCE.** An entrance that is not a service entrance or a restricted entrance.

**PUBLIC HOUSING.** *Housing facilities owned and/or operated by, for or on behalf of a public entity including but not limited to the following:*

1. Publicly owned and/or operated one- or two-family dwelling units or congregate residences;
2. Publicly owned and/or operated buildings or complexes with three or more residential dwelling units;
3. Publicly owned and/or operated housing provided by entities subject to regulations issued by the United States, Department of Housing and Urban Development under Section 504 of the Rehabilitation Act of 1973 as amended;
4. Publicly owned and/or operated homeless shelters, group homes and similar social service establishments;
5. Publicly owned and/or operated transient lodging, such as hotels, motels, hostels and other facilities providing accommodations of a short term nature of not more than 30 days duration;
6. Housing at a place of education owned or operated by a public entity, such as housing on or serving a public school, public college or public university campus;
7. Privately owned housing made available for public use as housing.

**PUBLIC POOL.** A pool other than a private pool.

**PUBLIC USE.** [DSA-AC] *Interior or exterior rooms, spaces or elements that are made available to the public. Public use may be provided at a building or facility that is privately or publicly owned. Private interior or exterior rooms, spaces or elements associated with a residential dwelling unit provided by a public housing program or in a public housing facility are not public use areas and shall not be required to be made available to the public. In the context of public housing,*

*public use is the provision of housing programs by, for or on behalf of a public entity.*

**PUBLIC-USE AREAS.** *Interior or exterior rooms or spaces of a building that are made available to the general public and do not include common use areas. Public use areas may be provided at a building that is privately or publicly owned.*

**[A] PUBLIC WAY.** A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

**[F] PYROPHORIC.** A chemical with an auto-ignition temperature in air, at or below a temperature of 130°F (54.4°C).

**[F] PYROTECHNIC COMPOSITION.** A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

**QUALIFIED HISTORIC BUILDING OR FACILITY.** *[DSA-AC] A building or facility that is listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate State or local law. See C.C.R. Title 24, Part 8.*

**RAFTERTAIL.** *[SFM] (See Chapter 7A, Section 702A for defined term.)*

**RAMP.** A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5-percent slope).

**RAMP-ACCESS OPEN PARKING GARAGES.** Open parking garages employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

**REASONABLE PORTION** *[DSA-AC] That segment of a building, facility, area, space or condition, which would normally be necessary if the activity therein is to be accessible by persons with disabilities.*

**RECESSED STEPS.** A riser/tread or series of risers/treads extending down into the deck with the bottom riser or tread terminating at the pool wall (thus creating a “stairwell”).

**RECESSED TREADS.** A series of vertically spaced cavities in the pool wall creating tread areas for step holes.

**RECIRCULATION SYSTEM.** The interconnected system traversed by the recirculated water from the pool until it is returned to the pool, i.e., from the pool through the collector or surge tank, recirculation pump, filters, chemical treatment and heater (if provided), and returned to the pool.

**RECOMMEND.** *[DSA-AC, HCD 1 & HCD 2] Does not require mandatory acceptance, but identifies a suggested action that shall be considered for the purpose of providing a greater degree of accessibility to persons with disabilities.*

**[F] RECORD DRAWINGS.** Drawings (“as built”) that document the location of all devices, appliances, wiring sequences, wiring methods and connections of the components of a fire alarm system as installed.

**REFLECTIVE PLASTIC CORE FOIL INSULATION.** An insulation material packaged in rolls, that is less than 0.5

inches thick, with at least one exterior low emittance surface (0.1 or less) and a core material containing voids or cells.

**[A] REGISTERED DESIGN PROFESSIONAL.** An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

**[A] REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE.** A registered design professional engaged by the owner to review and coordinate certain aspects of the project, as determined by the building official, for compatibility with the design of the building or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

**RELIGIOUS WORSHIP, PLACE OF.** A building or portion thereof intended for the performance of religious services.

**RELOCATABLE BUILDING (PUBLIC SCHOOL).** *Any building with an integral floor structure which is capable of being readily moved. (See Education Code Section 17350.) Relocatable buildings that are to be placed on substandard foundations not complying with the requirements of Part 2, Title 24, C.C.R., require a statement from the school district stating that the durability requirements for those foundations may be waived and acknowledging the temporary nature of the foundations.*

**REMODELING.** *[DSA-AC] See “Alteration.”*

**[A] REPAIR.** The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

**REROOFING.** The process of recovering or replacing an existing roof covering. See “Roof recover” and “Roof replacement.”

**RESIDENTIAL AIRCRAFT HANGAR.** An accessory building less than 2,000 square feet (186 m<sup>2</sup>) and 20 feet (6096 mm) in building height constructed on a one- or two-family property where aircraft are stored. Such use will be considered as a residential accessory use incidental to the dwelling.

**RESIDENTIAL CARE FACILITY FOR THE CHRONICALLY ILL (RCF/CI).** *As termed, means a housing arrangement with a maximum capacity of 25 residents that provides a range of services to residents who have chronic, life-threatening illnesses.*

**RESIDENTIAL CARE FACILITY FOR THE ELDERLY (RCFE).** *As defined in Health and Safety Code Section 1569.2, shall mean a facility with a housing arrangement chosen voluntarily by persons 60 years of age or over, or their authorized representative, where varying levels and intensities of care and supervision, protective supervision or personal care are provided, based on their varying needs, as determined in order to be admitted and to remain in the facility. Persons under 60 years of age with compatible needs, as determined by the Department of Social Services in regulations, may be allowed to be admitted or retained in a residential-care facility for the elderly.*

## DEFINITIONS

Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to Group R, Division 2 Occupancies classified as residential facilities (RF) and residential-care facilities for the elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is in consistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological, or topographical conditions relating to roof coverings for residential-care facilities for the elderly.

**RESIDENTIAL DWELLING UNIT. [DSA-AC]** A unit intended to be used as a residence that is primarily long-term in nature. Residential dwelling units do not include transient lodging, inpatient medical care, licensed long-term care, and detention or correctional facilities.

**RESIDENTIAL FACILITY (RF).** As defined in Section 1502 of the Health and Safety Code, shall mean any family home, group care facility or similar facility determined by the director of Social Services, for 24-hour nonmedical care of persons in need of personal services, supervision, or assistance essential for sustaining the activities of daily living or for the protection of the individual. Such facilities include small family homes and social rehabilitation facilities.

Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to Group R Occupancies classified as residential facilities (RF) and residential-care facilities for the elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is in consistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological, or topographical conditions relating to roof coverings for residential-care facilities for the elderly.

**RESISTANCE FACTOR.** A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure (also called “strength reduction factor”).

**RESTRAINT. [SFM]** The physical retention of a person within a room, cell or cell block, holding cells, temporary holding cell, rooms or area, holding facility, secure interview rooms, courthouse holding facilities, courtroom docks, or similar buildings or portions thereof by any means, or within the exterior walls of a building by means of locked doors inoperable by the person restrained. Restraint shall also

mean the physical binding, strapping or similar restriction of any person in a chair, walker, bed or other contrivance for the purpose of deliberately restricting the free movement of ambulatory persons.

Restraint shall not be construed to include nonambulatory persons nor shall it include the use of bandage material, strip sheeting or other fabrics or materials (soft ties) used to restrain persons in hospital-type beds or wheelchairs to prevent injury, provided an approved method of quick release is maintained.

Facilities employing the use of soft ties, however, shall be classified as a building used to house nonambulatory persons. Restraint shall not be practiced in licensed facilities classified as Group R-2.1, R-3.1 and R-4 occupancies unless constructed as a Group I-3 occupancy. For Group I-3 Occupancies see Section 408.1.1.

**RESTRICTED AREA. [OSHDP 1]** (See Chapter 12, Section 1224.3 for defined term.)

**RESTRICTED ENTRANCE.** An entrance that is made available for common use on a controlled basis, but not public use, and that is not a service entrance.

**RETRACTABLE AWNING.** A retractable awning is a cover with a frame that retracts against a building or other structure to which it is entirely supported.

**RETROFIT [DSA-SS, DSA-SS/CC, OSHPD 1, 2 & 4]** The construction of any new element or system, or the alteration of any existing element or system required to bring an existing building, or portion thereof, conforming to earlier code requirements, into conformance with standards of the currently effective California Building Standards Code.

**RISER.** The upright part between two adjacent stair treads.

**RISK CATEGORY.** A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance.

**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE<sub>R</sub>) GROUND MOTION RESPONSE ACCELERATIONS.** The most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk.

**ROOF ASSEMBLY (For application to Chapter 15 only).** A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering.

**ROOF COVERING.** The covering applied to the roof deck for weather resistance, fire classification or appearance.

**ROOF COVERING SYSTEM.** See “Roof assembly.”

**ROOF DECK.** The flat or sloped surface constructed on top of the exterior walls of a building or other supports for the purpose of enclosing the story below, or sheltering an area, to protect it from the elements, not including its supporting members or vertical supports.

**ROOF DRAINAGE, POSITIVE.** See “Positive roof drainage.”

**ROOF EAVE.** [SFM] (See Chapter 7A, Section 702A for defined term.)

**ROOF EAVE SOFFIT.** [SFM] (See Chapter 7A, Section 702A for defined term.)

**ROOF RECOVER.** The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

**ROOF REPAIR.** Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

**ROOF REPLACEMENT.** The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

**ROOF VENTILATION.** The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, attics, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

**ROOFTOP STRUCTURE.** A structure erected on top of the roof deck or on top of any part of a building.

**RUBBLE MASONRY.** Masonry composed of roughly shaped stones.

**Coursed rubble.** Masonry composed of roughly shaped stones fitting approximately on level beds and well bonded.

**Random rubble.** Masonry composed of roughly shaped stones laid without regularity of coursing but well bonded and fitted together to form well-divided joints.

**Rough or ordinary rubble.** Masonry composed of unsquared field stones laid without regularity of coursing but well bonded.

**RUGGED EQUIPMENT.** [DSA-SS, DSA-SS/CC & OSHPD 1, 2, 3 & 4] Rugged equipment refers to an ample-ness of construction that gives such equipment the ability to survive earthquake strong motions without significant loss of function.

**RUNNING BOND.** The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.

**RUNNING SLOPE.** The slope that is parallel to the direction of travel. (As differentiated from the definition of “Cross Slope”.)

**SALLYPORT.** A security vestibule with two or more doors or gates where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door or gate at a time.

**SANITARY FACILITY.** (HCD 1 & HCD 1-AC) Any single water closet, urinal, lavatory, bathtub or shower, or a combination thereof, together with the room or space in which they are housed.

**SCISSOR STAIR.** Two interlocking stairways providing two separate paths of egress located within one stairwell enclosure.

**SCUPPER.** An opening in a wall or parapet that allows water to drain from a roof.

**SECONDARY MEMBERS.** The following structural members shall be considered secondary members and not part of the primary structural frame:

1. Structural members not having direct connections to the columns;
2. Members of the floor construction and roof construction not having direct connections to the columns; and
3. Bracing members other than those that are part of the primary structural frame.

**SECURE INTERVIEW ROOMS.** A lockable room used to hold and interview detainees for further processing.

**SEISMIC DESIGN CATEGORY.** A classification assigned to a structure based on its risk category and the severity of the design earthquake ground motion at the site.

**SEISMIC FORCE-RESISTING SYSTEM.** That part of the structural system that has been considered in the design to provide the required resistance to the prescribed seismic forces.

**SELF-CLOSING.** As applied to a fire door or other opening protective, means equipped with an device that will ensure closing after having been opened.

**SELF-LUMINOUS.** Illuminated by a self-contained power source, other than batteries, and operated independently of external power sources.

**SELF-PRESERVATION, INCAPABLE OF.** See “Incapable of self-preservation.”

**SELF-SERVICE STORAGE.** [DSA-AC] Building or facility designed and used for the purpose of renting or leasing individual storage spaces to customers for the purpose of storing and removing personal property on a self-service basis.

**[F] SERVICE CORRIDOR.** A fully enclosed passage used for transporting HPM and purposes other than required means of egress.

**SERVICE ENTRANCE.** An entrance intended primarily for delivery of goods or services.

**SHAFT.** An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.

**SHAFT ENCLOSURE.** The walls or construction forming the boundaries of a shaft.

**SHALL.** [DSA-AC] Denotes a mandatory specification or requirement.

**SHALLOW FOUNDATION.** A shallow foundation is an individual or strip footing, a mat foundation, a slab-on-grade foundation or a similar foundation element.

**SHALLOW POOL.** A pool that has a maximum depth of less than 6 feet (1829 mm).

**SHEAR WALL.** (For Chapter 23) A wall designed to resist lateral forces parallel to the plane of a wall.

**Shear wall, perforated.** A wood structural panel sheathed wall with openings, that has not been specifically designed and detailed for force transfer around openings.

**Shear wall segment, perforated.** A section of shear wall with full-height sheathing that meets the height-to-width ratio limits of Section 4.3.4 of AF&PA SDPWS.

## **SHEAR WALL** (For Chapter 21)

**Detailed plain masonry shear wall.** A masonry shear wall designed to resist lateral forces neglecting stresses in reinforcement, and designed in accordance with Section 2106.1.

**Intermediate prestressed masonry shear wall.** A prestressed masonry shear wall designed to resist lateral forces considering stresses in reinforcement, and designed in accordance with Section 2106.1.

**Intermediate reinforced masonry shear wall.** A masonry shear wall designed to resist lateral forces considering stresses in reinforcement, and designed in accordance with Section 2106.1.

**Ordinary plain masonry shear wall.** A masonry shear wall designed to resist lateral forces neglecting stresses in reinforcement, and designed in accordance with Section 2106.1.

**Ordinary plain prestressed masonry shear wall.** A prestressed masonry shear wall designed to resist lateral forces considering stresses in reinforcement, and designed in accordance with Section 2106.1.

**Ordinary reinforced masonry shear wall.** A masonry shear wall designed to resist lateral forces considering stresses in reinforcement, and designed in accordance with Section 2106.1.

**Special prestressed masonry shear wall.** A prestressed masonry shear wall designed to resist lateral forces considering stresses in reinforcement and designed in accordance with Section 2106.1 except that only grouted, laterally restrained tendons are used.

**Special reinforced masonry shear wall.** A masonry shear wall designed to resist lateral forces considering stresses in reinforcement, and designed in accordance with Section 2106.1.

**SHOPPING CENTER (OR SHOPPING MALL).** [DSA-AC] *One or more sales or rental establishments or stores. A shopping center may include a series of buildings on a common site, connected by a common pedestrian access route on, above or below the ground floor, that is either under common ownership or common control or developed either as one project or as a series of related projects. For the purposes of this section, “shopping center” or “shopping mall” includes a covered mall building.*

**SHOULD.** [DSA-AC] *Denotes an advisory specification or recommendation. [HCD 1 & HCD 2] See “Recommend.”*

**SIDEWALK.** *A surfaced pedestrian way contiguous to a street used by the public. (As differentiated from the definition of “Walk”.)*

**SIGNAGE [DSA-AC]** *Displayed verbal, symbolic, tactile, and/or pictorial information.*

**SIGNIFICANT LOSS OF FUNCTION.** [DSA-SS, DSA-SS/CC & OSHPD 1, 2, & 4] *Significant loss of function for equipment or components means the equipment or component cannot be restored to its original function by competent technicians after a design earthquake because the equipment or component require parts that are not normally stocked by the owner or not readily available.*

**SINGLE-ACCOMMODATION SANITARY FACILITY.** [HCD 1-AC] *A room that has not more than one of each type of sanitary fixture, is intended for use by only one person at a time, has no partition around the toilet, and has a door that can be locked on the inside by the room occupant.*

**SINGLE-PLY MEMBRANE.** A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

**[F] SINGLE-STATION SMOKE ALARM.** An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

**SINK.** *A fixed bowl or basin with running water and drain-pipe, as in a kitchen or laundry, for washing dishes, clothing, etc. (As differentiated from the definition of “Lavatory”).*

**SITE.** A parcel of land bounded by a lot line or a designated portion of a public right-of-way.

**SITE CLASS.** A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 1613.3.2.

**SITE COEFFICIENTS.** The values of  $F_a$  and  $F_v$  indicated in Tables 1613.3.3(1) and 1613.3.3(2), respectively.

**SITE DEVELOPMENT.** [HCD 1-AC] *“On-site” and “off-site” work, including, but not limited to, walks, sidewalks, ramps, curbs, curb ramps, parking facilities, stairs, planting areas, pools, promenades, exterior gathering or assembly areas and raised or depressed paved areas.*

**SITE-FABRICATED STRETCH SYSTEM.** A system, fabricated on site and intended for acoustical, tackable or aesthetic purposes, that is comprised of three elements:

1. A frame (constructed of plastic, wood, metal or other material) used to hold fabric in place,
2. A core material (infill, with the correct properties for the application), and
3. An outside layer, comprised of a textile, fabric or vinyl, that is stretched taut and held in place by tension or mechanical fasteners via the frame.

**SKYLIGHT, UNIT.** A factory-assembled, glazed fenestration unit, containing one panel of glazing material that allows for natural lighting through an opening in the roof assembly while preserving the weather-resistant barrier of the roof.

**SKYLIGHTS AND SLOPED GLAZING.** Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Glazing mate-



rial in skylights, including unit skylights, solariums, sun-rooms, roofs and sloped walls, are included in this definition.

**SLEEPING ACCOMMODATIONS.** *Rooms intended and designed for sleeping.*

**SLEEPING UNIT.** A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

**SLIP RESISTANT.** *A rough finish that is not abrasive to the bare foot.*

**SLOPE.** *[HCD 1-AC] The relative steepness of the land between two points and is calculated as follows:*

*The horizontal distance and elevation change between the two points (e.g., an entrance and a passenger loading zone). The difference in elevation is divided by the distance and the resulting fraction is multiplied by 100 to obtain the percent of slope.*

*For example: if a principal entrance is 10 feet (3048 mm) from a passenger loading zone, and the principal entrance is raised 1 foot (305 mm) higher than the passenger loading zone, then the slope is  $1/10 \times 100 = 10$  percent.*

**SMALL MANAGEMENT YARD.** *An exterior exercise yard within a Group I-3 prison used for inmate exercise for a maximum of 2 hours per day, constructed in accordance with Section 408.1.2.3.*

**[F] SMOKE ALARM.** A single- or multiple-station alarm responsive to smoke. See also definitions of "Multiple-station smoke alarm" and "Single station smoke alarm."

**SMOKE BARRIER.** A continuous membrane, either vertical or horizontal, such as a wall, floor or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

**SMOKE COMPARTMENT.** A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

**SMOKE DAMPER.** A listed device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

**[F] SMOKE DETECTOR.** A listed device that senses visible or invisible particles of combustion.

**SMOKE-DEVELOPED INDEX.** A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E 84.

**SMOKE-PROTECTED ASSEMBLY SEATING.** Seating served by means of egress that is not subject to smoke accumulation within or under a structure.

**SMOKEPROOF ENCLOSURE.** An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.

**SOFT CONTAINED PLAY STRUCTURE.** *[DSA-AC] A play structure made up of one or more play components where the user enters a fully enclosed play environment that utilizes pliable materials, such as plastic, netting or fabric.*

**[F] SOLID.** A material that has a melting point, decomposes or sublimates at a temperature greater than 68°F (20°C).

**SPACE.** *A definable area, such as, a room, toilet room, hall, assembly area, entrance, storage room, alcove, courtyard, or lobby.*

**SPECIAL AMUSEMENT BUILDING.** A special amusement building is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and that contains a device or system that conveys passengers or provides a walkway along, around or over a course in any direction so arranged that the means of egress path is not readily apparent due to visual or audio distractions or is intentionally confounded or is not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

**SPECIAL FLOOD HAZARD AREA.** The land area subject to flood hazards and shown on a *Flood Insurance Rate Map* or other flood hazard map as Zone A, AE, A1-30, A99, AR, AO, AH, V, VO, VE or V1-30.

**SPECIAL INSPECTION.** Inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with this code and the approved construction documents.

**Continuous special inspection.** Special inspection by the special inspector who is present when and where the work to be inspected is being performed.

**Periodic special inspection.** Special inspection by the special inspector who is intermittently present where the work to be inspected has been or is being performed.

**SPECIAL INSPECTOR.** A qualified person employed or retained by an approved agency and approved by the building official as having the competence necessary to inspect a particular type of construction requiring special inspection.

**SPECIAL STRUCTURAL WALL.** See Section 1905.1.1.

**SPECIFIED.** Required by construction documents.

**SPECIFIED COMPRESSIVE STRENGTH OF MASONRY,  $f'_m$ .** Minimum compressive strength, expressed as force per unit of net cross-sectional area, required of the masonry used in construction by the construction documents, and upon which the project design is based. Whenever the quantity  $f'_m$  is under the radical sign, the square root of numerical value only is intended and the result has units of pounds per square inch (psi) (MPa).

**SPECIFIED PUBLIC TRANSPORTATION.** *[DSA-AC] Transportation by bus, rail or any other conveyance (other than by aircraft) that provides the general public with general or special service (including charter service) on a regular and continuing basis.*

**SPC 1, SPC 2, SPC 3, SPC 4 and SPC 5** are the building structural performance categories for Hospital Buildings defined in Table 2.5.3 of California Administrative Code (Part 1, Title 24 CCR), Chapter 6.

## DEFINITIONS

**SPLICE.** The result of a factory and/or field method of joining or connecting two or more lengths of a fire-resistant joint system into a continuous entity.

**SPRAYED FIRE-RESISTANT MATERIALS.** Cementitious or fibrous materials that are sprayed to provide fire-resistant protection of the substrates.

**STACK BOND.** The placement of masonry units in a bond pattern is such that head joints in successive courses are vertically aligned. For the purpose of this code, requirements for stack bond shall apply to masonry laid in other than running bond.

**STAGE.** A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.

**STAIR.** A change in elevation, consisting of one or more risers.

|| **STAIRS.** *A series of two or more steps.*

**STAIR, SCISSOR.** See “Scissor stair.”

**STAIRWAY.** One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

**STAIRWAY, EXIT ACCESS.** See “Exit access stairway.”

**STAIRWAY, EXTERIOR.** A stairway that is open on at least one side, except for required structural columns, beams, handrails and guards. The adjoining open areas shall be either yards, courts or public ways. The other sides of the exterior stairway need not be open.

**STAIRWAY, INTERIOR.** A stairway not meeting the definition of an exterior stairway.

**STAIRWAY, INTERIOR EXIT.** See “Interior exit stairway.”

**STAIRWAY, SPIRAL.** A stairway having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

**[F] STANDPIPE SYSTEM, CLASSES OF.** Standpipe classes are as follows:

**Class I system.** A system providing 2½-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

**Class II system.** A system providing 1½-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

**Class III system.** A system providing 1½-inch (38 mm) hose stations to supply water for use by building occupants and 2½-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

**[F] STANDPIPE, TYPES OF.** Standpipe types are as follows:

**Automatic dry.** A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a

device, such as dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.

**Automatic wet.** A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

**Manual dry.** A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to meet the system demand.

**Manual wet.** A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. Manual-wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to meet the system demand.

**Semiautomatic dry.** A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

**START OF CONSTRUCTION.** The date of issuance for new construction and substantial improvements to existing structures, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement or other improvement is within 180 days after the date of issuance. The actual start of construction means the first placement of permanent construction of a building (including a manufactured home) on a site, such as the pouring of a slab or footings, installation of pilings or construction of columns.

Permanent construction does not include land preparation (such as clearing, excavation, grading or filling), the installation of streets or walkways, excavation for a basement, footings, piers or foundations, the erection of temporary forms or the installation of accessory buildings such as garages or sheds not occupied as dwelling units or not part of the main building. For a substantial improvement, the actual “start of construction” means the first alteration of any wall, ceiling, floor or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

**STATE-OWNED/LEASED BUILDING.** [SFM] *State-Owned/Leased Building is a building or portion of a building that is owned, leased or rented by the state. State-leased buildings shall include all required exits to a public way serving such leased area or space. Portions of state-leased buildings that are not leased or rented by the state shall not be included within the scope of this section unless such portions present an exposure hazard to the state-leased area or space.*

**STATE RESPONSIBILITY AREA.** [SFM] *(See Chapter 7A, Section 702A for definition of term.)*

**STATION. [SFM]** (See Chapter 4, Section 433 for definition of term.)

**STATION PLATFORM. [SFM]** (See Chapter 4, Section 433 for definition of term.)

**STEEL CONSTRUCTION, COLD-FORMED.** That type of construction made up entirely or in part of steel structural members cold formed to shape from sheet or strip steel such as roof deck, floor and wall panels, studs, floor joists, roof joists and other structural elements.

**STEEL JOIST.** Any steel structural member of a building or structure made of hot-rolled or cold-formed solid or open-web sections, or riveted or welded bars, strip or sheet steel members, or slotted and expanded, or otherwise deformed rolled sections.

**STEEL MEMBER, STRUCTURAL.** Any steel structural member of a building or structure consisting of a rolled steel structural shape other than cold-formed steel, or steel joist members.

**STEEP SLOPE.** A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

**STEPS, RECESSED STEPS, LADDERS AND RECESSED TREADS.** Those means of entry and exit to and from the pool which may be used in conjunction with each other.

**STEP.** A riser and tread.

**STONE MASONRY.** Masonry composed of field, quarried or cast stone units bonded by mortar.

**Ashlar stone masonry.** Stone masonry composed of rectangular units having sawed, dressed or squared bed surfaces and bonded by mortar.

**Rubble stone masonry.** Stone masonry composed of irregular-shaped units bonded by mortar.

**[F] STORAGE, HAZARDOUS MATERIALS.** The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders, or similar vessels; or vessels supplying operations through closed connections to the vessel.

**STORM SHELTER.** A building, structure or portions thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.

**Community storm shelter.** A storm shelter not defined as a "Residential Storm Shelter."

**Residential storm shelter.** A storm shelter serving occupants of dwelling units and having an occupant load not exceeding 16 persons.

**STORY.** That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (also see "Basement," "Building height," "Grade plane" and "Mezzanine"). It is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

**[DSA-AC]** That portion of a building or facility designed for human occupancy included between the upper surface of a floor and upper surface of the floor or roof next above. A story containing one or more mezzanines has more than one floor level. If the finished floor level directly above a basement or unused under-floor space is more than six feet (1829 mm) above grade for more than 50 percent of the total perimeter or is more than 12 feet (3658 mm) above grade at any point, the basement or unused under-floor space shall be considered as a story.

**STORY ABOVE GRADE PLANE.** Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:

1. More than 6 feet (1829 mm) above grade plane; or
2. More than 12 feet (3658 mm) above the finished ground level at any point.

#### STRENGTH (For Chapter 21).

**Design strength.** Nominal strength multiplied by a strength reduction factor.

**Nominal strength.** Strength of a member or cross section calculated in accordance with these provisions before application of any strength-reduction factors.

**Required strength.** Strength of a member or cross section required to resist factored loads.

#### STRENGTH (For Chapter 16).

**Nominal strength.** The capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and equations derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions.

**Required strength.** Strength of a member, cross section or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by these provisions.

**Strength Design.** A method of proportioning structural members such that the computed forces produced in the members by factored loads do not exceed the member design strength [also called "load and resistance factor design" (LRFD)]. The term "strength design" is used in the design of concrete and masonry structural elements.

**STRUCTURAL COMPOSITE LUMBER.** Structural member manufactured using wood elements bonded together with exterior adhesives. Examples of structural composite lumber are:

**Laminated strand lumber (LSL).** A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inches (2.54 mm) or less and their average lengths are a minimum of 150 times the least dimension of the wood strand elements.

**Laminated veneer lumber (LVL).** A composite of wood veneer sheet elements with wood fibers primarily oriented

along the length of the member, where the veneer element thicknesses are 0.25 inches (6.4 mm) or less.

**Oriented strand lumber (OSL).** A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inches (2.54 mm) or less and their average lengths are a minimum of 75 times and less than 150 times the least dimension of the wood strand elements.

**Parallel strand lumber (PSL).** A composite of wood strand elements with wood fibers primarily oriented along the length of the member where the least dimension of the wood strand elements is 0.25 inches (6.4 mm) or less and their average lengths are a minimum of 300 times the least dimension of the wood strand elements.

**STRUCTURAL FRAME.** [DSA-AC] *The columns and the girders, beams and trusses having direct connections to the columns and all other members that are essential to the stability of the building or facility as a whole.*

**STRUCTURAL GLUED-LAMINATED TIMBER.** An engineered, stress-rated product of a timber laminating plant, comprised of assemblies of specially selected and prepared wood laminations in which the grain of all laminations is approximately parallel longitudinally and the laminations are bonded with adhesives.

**STRUCTURAL OBSERVATION.** The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspection required by Section 110, 1705 or other sections of this code.

**[A] STRUCTURE.** That which is built or constructed.

**SUBDIAPHRAGM.** A portion of a larger wood diaphragm designed to anchor and transfer local forces to primary diaphragm struts and the main diaphragm.

**SUBSTANTIAL DAMAGE.** Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

**SUBSTANTIAL IMPROVEMENT.** Any repair, reconstruction, rehabilitation, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the building official and that are the minimum necessary to assure safe living conditions.
2. Any alteration of a historic structure provided that the alteration will not preclude the structure's continued designation as a historic structure.

**SUBSTANTIAL STRUCTURAL DAMAGE.** [OSHPD 1 & 4] A condition where:

1. In any story, the vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of the structure in any horizontal direction has been reduced by more than 10 percent from its predamage condition; or
2. The capacity of any vertical gravity load-carrying component, or any group of such components, that supports more than 30 percent of the total area of the structure's floors and roofs has been reduced more than 10 percent from its predamage condition and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by this code for new buildings of similar structure, purpose and location.

**[E] SUNROOM.** A one-story structure attached to a building with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

**[F] SUPERVISING STATION.** A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

**[F] SUPERVISORY SERVICE.** The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property.

**[F] SUPERVISORY SIGNAL.** A signal indicating the need of action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

**[F] SUPERVISORY SIGNAL-INITIATING DEVICE.** An initiation device, such as a valve supervisory switch, water-level indicator or low-air pressure switch on a dry-pipe sprinkler system, whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system, or a need for action in connection with guard tours, fire suppression systems or equipment or maintenance features of related systems.

**SUSCEPTIBLE BAY.** A roof or portion thereof with:

1. A slope less than  $\frac{1}{4}$ -inch per foot (0.0208 rad); or
2. On which water is impounded upon it, in whole or in part, and the secondary drainage system is functional but the primary drainage system is blocked.

A roof surface with a slope of  $\frac{1}{4}$ -inch per foot (0.0208 rad) or greater towards points of free drainage is not a susceptible bay.

**SWIMMING POOL.** Any structure intended for swimming, recreational bathing or wading that contains water over 24 inches (610 mm) deep. This includes in-ground, above-ground and on-ground pools; hot tubs; spas and fixed-in-place wading pools.

**T RATING.** The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E 814 or UL 1479.

**TACTILE.** *An object that can be perceived using the sense of touch.*

**TACTILE SIGN.** *A sign containing raised characters and/or symbols and accompanying Braille.*

**TECHNICAL PRODUCTION AREA.** Open elevated areas or spaces intended for entertainment technicians to walk on and occupy for servicing and operating entertainment technology systems and equipment. Galleries, including fly and lighting galleries, gridirons, catwalks, and similar areas are designed for these purposes.

**TECHNICALLY INFEASIBLE.** An alteration of a building or a facility that has little likelihood of being accomplished because the existing structural conditions require the removal or alteration of a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modification or addition of elements, spaces or features which are in full and strict compliance with the minimum requirements for new construction and which are necessary to provide accessibility.

**TEEING GROUND. [DSA-AC]** *In golf, the starting place for the hole to be played.*

**TEMPORARY [DSA-AC]** *Buildings and facilities intended for use at one location for not more than one year and seats intended for use at one location for not more than 90 days.*

**TEMPORARY HOLDING CELL, ROOM or AREA. [CSA and SFM]** *Temporary Holding cell, room or area shall mean a room for temporary holding of inmates, detainees or in-custody individuals for less than 24 hours.*

**TEMPORARY HOLDING FACILITY [SFM]** *A building or portion of a building, operated by law enforcement personnel, with one or more temporary holding cells or rooms.*

**TENABLE ENVIRONMENT [SFM]** *Tenable environment shall mean an environment in which the products of combustion, toxic gases, smoke and heat are limited or otherwise restricted to maintain the impact on occupants to a level that is not life threatening.*

**TENT.** A structure, enclosure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported in any manner except by air or the contents it protects.

**TERMINALLY ILL.** *As termed for an individual, means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon.*

**TESTING AGENCY. (HCD 1 & HCD 2)** *An agency approved by the department as qualified and equipped for testing of products, materials, equipment and installations in accordance with nationally recognized standards. For additional information, see Health and Safety Code Section 17920(m).*

**TEXT TELEPHONE.** *Machinery or equipment that employs interactive text-based communications through the transmission of coded signals across the standard telephone network. Text telephones can include, for example, devices known as TTYs (teletypewriters) or computers.*

**[E] THERMAL ISOLATION.** A separation of conditioned spaces, between a sunroom and a dwelling unit, consisting of existing or new walls, doors or windows.

**THERMOPLASTIC MATERIAL.** A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

**THERMOSETTING MATERIAL.** A plastic material that is capable of being changed into a substantially nonreformable product when cured.

**THIN-BED MORTAR.** Mortar for use in construction of AAC unit masonry with joints 0.06 inch (1.5 mm) or less.

**THROUGH PENETRATION.** A breach in both sides of a floor, floor-ceiling or wall assembly to accommodate an item passing through the breaches.

**THROUGH-PENETRATION FIRESTOP SYSTEM.** An assemblage consisting of a fire-resistance-rated floor, floor-ceiling, or wall assembly, one or more penetrating items passing through the breaches in both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time.

**TIE-DOWN (HOLD-DOWN).** A device used to resist uplift of the chords of shear walls.

**TIE, WALL.** Metal connector that connects wythes of masonry walls together.

**TILE, STRUCTURAL CLAY.** A hollow masonry unit composed of burned clay, shale, fire clay or mixture thereof, and having parallel cells.

**[F] TIRES, BULK STORAGE OF.** Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m<sup>3</sup>).

**[A] TOWNHOUSE.** A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

**[F] TOXIC.** A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD<sub>50</sub>) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD<sub>50</sub>) of more than 200 milligrams per kilogram, but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC<sub>50</sub>) in air of more than 200 parts per million, but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or

## DEFINITIONS

less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

**TRANSFER DEVICE.** [DSA-AC] *Equipment designed to facilitate the transfer of a person from a wheelchair or other mobility aid to and from an amusement ride seat.*

**TRANSIENT.** Occupancy of a dwelling unit or sleeping unit for not more than 30 days.

**TRANSIENT AIRCRAFT.** Aircraft based at another location and that is at the transient location for not more than 90 days.

**TRANSIENT LODGING.** *A building or facility containing one or more guest room(s) for sleeping that provides accommodations that are primarily short-term in nature (generally 30 days or less). Transient lodging does not include residential dwelling units intended to be used as a residence, inpatient medical care facilities, licensed long-term care facilities, detention or correctional facilities, or private buildings or facilities that contain no more than five rooms for rent or hire and that are actually occupied by the proprietor as the residence of such proprietor.*

[DSA-AC] *See also the definition of Place of Public Accommodation.*

**TRANSIT BOARDING PLATFORM.** [DSA-AC] *A horizontal, generally level surface, whether raised above, recessed below or level with a transit rail, from which persons embark/disembark a fixed rail vehicle.*

**TRANSITION PLATE.** [DSA-AC] *A sloping pedestrian walking surface located at the end(s) of a gangway.*

**TREAD.** *The horizontal part of a step.*

**TREATED WOOD.** Wood and wood-based materials that use vacuum-pressure impregnation processes to enhance fire retardant or preservative properties.

**Fire-retardant-treated wood.** Pressure-treated lumber and plywood that exhibit reduced surface-burning characteristics and resist propagation of fire.

**Preservative-treated wood.** Pressure-treated wood products that exhibit reduced susceptibility to damage by fungi, insects or marine borers.

**TREATMENT OF WATER.** *The process of conditioning and disinfection of pool water by means of a combination of filtration and the addition of chemicals to the water.*

**TRIM.** Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.

**[F] TROUBLE SIGNAL.** A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

**TTY.** *An abbreviation for teletypewriter. Machinery that employs interactive text-based communication through the transmission of coded signals across the telephone network. TTys may include, for example, devices known as TDDs (telecommunication display devices or telecommunication devices for deaf persons) or computers with special modems. TTys are also called text telephones.*

**TUBULAR DAYLIGHTING DEVICE (TDD).** A non-operable fenestration unit primarily designed to transmit daylight from a roof surface to an interior ceiling via a tubular conduit. The basic unit consists of an exterior glazed weathering surface, a light-transmitting tube with a reflective interior surface, and an interior-sealing device such as a translucent ceiling panel. The unit can be factory assembled, or field-assembled from a manufactured kit.

**24-HOUR CARE.** See “24-hour care” located preceding “AAC masonry.”

**TURNOVER TIME.** *The period of time, in hours, required to circulate a volume of water equal to the pool capacity.*

**UNDERGROUND STATION.** [SFM] *(See Chapter 4, Section 433 for definition of term.)*

**UNDERLAYMENT.** One or more layers of felt, sheathing paper, nonbituminous saturated felt or other approved material over which a steep-slope roof covering is applied.

**UNIFORMITY COEFFICIENT.** *The ratio of theoretical size of a sieve that will pass 60 percent of the sand to the theoretical size of sieve that will pass 10 percent.*

**UNIT SKYLIGHT.** See “Skylight, unit.”

**UNREASONABLE HARDSHIP.** *When the enforcing agency finds that compliance with the building standard would make the specific work of the project affected by the building standard infeasible, based on an overall evaluation of the following factors:*

1. *The cost of providing access.*
2. *The cost of all construction contemplated.*
3. *The impact of proposed improvements on financial feasibility of the project.*
4. *The nature of the accessibility which would be gained or lost.*
5. *The nature of the use of the facility under construction and its availability to persons with disabilities.*

*The details of any finding of unreasonable hardship shall be recorded and entered in the files of the enforcing agency.*

**[F] UNSTABLE (REACTIVE) MATERIAL.** A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Unstable (reactive) materials are subdivided as follows:

**Class 4.** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

**Class 3.** Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class

includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

**Class 2.** Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

**Class 1.** Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

**[F] USE (MATERIAL).** Placing a material into action, including solids, liquids and gases.

**USE ZONE. [DSA-AC]** *The ground level area beneath and immediately adjacent to a play structure or play equipment that is designated by ASTM F 1487 for unrestricted circulation around the play equipment and where it is predicted that a user would land when falling from or exiting the play equipment.*

**VALUATION THRESHOLD. [DSA-AC]** *An annually adjusted, dollar-amount figure used in part to determine the extent of required path of travel upgrades. The baseline valuation threshold of \$50,000 is based on the January 1981, "ENR US20 Cities" Average Construction Cost Index (CCI) of 3372.02 as published in Engineering News Record, McGraw Hill Publishing Company. The current valuation threshold is determined by multiplying the baseline valuation threshold by a ratio of the current year's January CCI to the baseline January 1981 CCI.*

**VAPOR PERMEABLE MEMBRANE.** The property of having a moisture vapor permeance rating of 10 perms ( $5.7 \times 10^{-10}$  kg/Pa  $\times$  s  $\times$  m<sup>2</sup>) or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96. A vapor permeable material permits the passage of moisture vapor.

**VAPOR RETARDER CLASS.** A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E 96 as follows:

**Class I:** 0.1 perm or less.

**Class II:**  $0.1 < \text{perm} \leq 1.0$  perm.

**Class III:**  $1.0 < \text{perm} \leq 10$  perm.

**VEHICLE BARRIER.** A component or a system of components, near open sides of a garage floor or ramp or building walls that act as restraints for vehicles.

**VEHICULAR GATE.** A gate that is intended for use at a vehicular entrance or exit to a facility, building or portion thereof, and that is not intended for use by pedestrian traffic.

**VEHICULAR OR PEDESTRIAN ARRIVAL POINTS. [HCD 1-AC]** *Public or resident parking areas, public transportation stops, passenger loading zones, and public streets or sidewalks.*

**VEHICULAR WAY.** *A route provided for vehicular traffic, such as in a street, driveway, or parking facility.*

**VENEER.** A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

**[M] VENTILATION.** The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

**VINYL SIDING.** A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used as an exterior wall covering.

**[F] VISIBLE ALARM NOTIFICATION APPLIANCE.** A notification appliance that alerts by the sense of sight.

**WAITING ROOM. [SFM]** *Waiting room is a room or area normally provided with seating and used for persons waiting.*

**WALK. [DSA-AC]** *An exterior prepared surface for pedestrian use, including pedestrian areas such as plazas and courts. (As differentiated from the definition of "Sidewalk".) [HCD 1-AC]* *A surfaced pedestrian way not located contiguous to a street used by the public. (See also "Sidewalk".)*

**WALKWAY, PEDESTRIAN.** A walkway used exclusively as a pedestrian trafficway.

**WALL.** A vertical element with a horizontal length-to-thickness ratio greater than three, used to enclose space.

**Cavity wall.** A wall built of masonry units or of concrete, or a combination of these materials, arranged to provide an airspace within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

**Composite wall.** A wall built of a combination of two or more masonry units bonded together, one forming the backup and the other forming the facing elements.

**Dry-stacked, surface-bonded wall.** A wall built of concrete masonry units where the units are stacked dry, without mortar on the bed or head joints, and where both sides of the wall are coated with a surface-bonding mortar.

**Masonry-bonded hollow wall.** A multi-wythe wall built of masonry units arranged to provide an air space between the wythes and with the wythes bonded together with masonry units.

**Parapet wall.** The part of any wall entirely above the roof line.

**WALL, LOAD-BEARING.** Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.
2. Any masonry or concrete wall that supports more than 200 pounds per linear foot (2919 N/m) of vertical load in addition to its own weight.

**WALL, NONLOAD-BEARING.** Any wall that is not a load-bearing wall.

**WALL PIER.** See Section 1905.1.1.

## DEFINITIONS

**WATERLINE.** *Shall be defined as one of the following:*

1. *Skimmer systems. The waterline shall be the midpoint of the operating range of the skimmers.*
2. *Overflow system. The waterline shall be the top edge of the overflow rim.*

**[F] WATER-REACTIVE MATERIAL.** A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

**Class 3.** Materials that react explosively with water without requiring heat or confinement.

**Class 2.** Materials that react violently with water or have the ability to boil water. Materials that produce flammable, toxic or other hazardous gases or evolve enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture.

**Class 1.** Materials that react with water with some release of energy, but not violently.

**WATER-RESISTIVE BARRIER.** A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

**WEATHER-EXPOSED SURFACES.** Surfaces of walls, ceilings, floors, roofs, soffits and similar surfaces exposed to the weather except the following:

1. Ceilings and roof soffits enclosed by walls, fascia, bulkheads or beams that extend a minimum of 12 inches (305 mm) below such ceiling or roof soffits.
2. Walls or portions of walls beneath an unenclosed roof area, where located a horizontal distance from an open exterior opening equal to at least twice the height of the opening.
3. Ceiling and roof soffits located a minimum horizontal distance of 10 feet (3048 mm) from the outer edges of the ceiling or roof soffits.

**WET BAR. [DSA-AC]** *An area or space with a counter equipped with a sink and running water but without cooking facilities.*

**[F] WET-CHEMICAL EXTINGUISHING SYSTEM.** A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

**WHEELCHAIR.** *A chair mounted on wheels to be propelled by its occupant manually or with the aid of electric power, of a size and configuration conforming to the recognized standard models of the trade.*

**WHEELCHAIR SPACE.** A space for a single wheelchair and its occupant.

**WILDFIRE. [SFM]** *(See Chapter 7A, Section 702A for defined term.)*

**WILDFIRE EXPOSURE. [SFM]** *(See Chapter 7A, Section 702A for defined term.)*

**WILDLAND-URBAN INTERFACE FIRE AREA. [SFM]** *(See Chapter 7A, Section 702A for defined term.)*

**WINERY CAVES.** *See Section 436.*

**WIND-BORNE DEBRIS REGION.** Areas within hurricane-prone regions located:

1. Within 1 mile (1.61 km) of the coastal mean high water line where the ultimate design wind speed,  $V_{ult}$  is 130 mph (58 m/s) or greater; or
2. In areas where the ultimate design wind speed is 140 mph (63.6 m/s) or greater; or Hawaii.

For Risk Category II buildings and structures and Risk Category III buildings and structures, except health care facilities, the windborne debris region shall be based on Figure 1609A. For Risk Category IV buildings and structures and Risk Category III health care facilities, the windborne debris region shall be based on Figure 1609B.

**WINDFORCE-RESISTING SYSTEM, MAIN.** *See "Main Windforce-Resisting System."*

**WIND SPEED,  $V_{ult}$ .** Ultimate design wind speeds.

**WIND SPEED,  $V_{asd}$ .** Nominal design wind speeds.

**WINDER.** A tread with nonparallel edges.

**WIRE BACKING.** Horizontal strands of tautened wire attached to surfaces of vertical supports which, when covered with the building paper, provide a backing for cement plaster

**[F] WIRELESS PROTECTION SYSTEM.** A system or a part of a system that can transmit and receive signals without the aid of wire.

**WOOD SHEAR PANEL.** A wood floor, roof or wall component sheathed to act as a shear wall or diaphragm.

**WOOD STRUCTURAL PANEL.** A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

**Composite panels.** A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive;

**Oriented strand board (OSB).** A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive; or

**Plywood.** A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

**[F] WORKSTATION.** A defined space or an independent principal piece of equipment using HPM within a fabrication area where a specific function, laboratory procedure or research activity occurs. Approved or listed hazardous materials storage cabinets, flammable liquid storage cabinets or gas cabinets serving a workstation are included as part of the workstation. A workstation is allowed to contain ventilation



equipment, fire protection devices, detection devices, electrical devices and other processing and scientific equipment.

**[DSA-AC]** *An area defined by equipment and/or work surfaces intended for use by employees only, and generally for one or a small number of employees at a time. Examples include ticket booths; the employee side of grocery store check stands; the bartender area behind a bar; the employee side of snack bars, sales counters and public counters; guardhouses; toll booths; kiosk vending stands; lifeguard stations; maintenance equipment closets; counter and equipment areas in restaurant kitchens; file rooms; storage areas; etc.*

**WORK AREA EQUIPMENT.** **[DSA-AC]** *Any machine, instrument, engine, motor, pump, conveyor, or other apparatus used to perform work. As used in this document, this term shall apply only to equipment that is permanently installed or built-in in employee work areas. Work area equipment does not include passenger elevators and other accessible means of vertical transportation.*

**WYTHER.** Each continuous, vertical section of a wall, one masonry unit in thickness.

**YARD.** An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.

**[F] ZONE.** A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent or an area in which a form of control can be executed.

**[F] ZONE, NOTIFICATION.** An area within a building or facility covered by notification appliances which are activated simultaneously.



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 3 – USE AND OCCUPANCY CLASSIFICATION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below															X			X		
Chapter / Section																				
302.1		X																		
302.1.3																				
303.1		X																		
303.1.1		X																		
303.1.2		X																		
303.1.3		X																		
303.1.4		X																		
303.2		X																		
303.7		X	X	X																
303.8		X																		
304.1		X																		
304.2 Clinic, Outpatient		X																		
305.1 w/ Exception		X																		
305.2 w/ Exception		X																		
306.2		X																		
306.4-306.4.4		X																		
307.1		X																		
Table 307.1(1) Footnote d		X																		
Table 307.1(2) Footnote e		X																		
307.1.1		X																		
308.1		X																		
308.2 Detoxification facilities		X																		
308.2 Hospitals and Mental hospitals		X																		
308.2 Nursing Homes		X																		
308.3		X	X	X																
308.4		X							X	X		X								
308.4.2		X							X	X		X								
308.5		X	X	X																
308.5.1		X																		
308.5.2		X																		
308.5.6		X																		
308.5.7		X																		
308.5.8		X																		
308.6		X																		
308.6.1		X																		
308.6.2.1		X																		
310.1		X	X	X																
310.2		X																		

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 3 – USE AND OCCUPANCY CLASSIFICATION—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below															X			X		
Chapter / Section																				
310.3		X																		
310.4		X																		
310.4.1		X																		
310.5		X																		
310.5.1		X																		
310.6		X																		
313		X																		
313.1		X																		

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

## CHAPTER 3

# USE AND OCCUPANCY CLASSIFICATION

### SECTION 301 GENERAL

**301.1 Scope.** The provisions of this chapter shall control the classification of all buildings and structures as to use and occupancy.

### SECTION 302 CLASSIFICATION

**302.1 General.** Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in this section. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5
2. Business (see Section 304): Group B
3. Educational (see Section 305): Group E
4. Factory and Industrial (see Section 306): Groups F-1 and F-2
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5
6. Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4
7. *Laboratory (see Section 202): Group B, unless classified as Group L (see Section 443) or Group H (see Section 307).*
8. Mercantile (see Section 309): Group M
9. *[SFM] Organized Camps (see Section 440): Group C10.*
10. *[SFM] Research Laboratories (see Section 443): Group L*
11. *Residential (see Section 310): Groups R-1, R-2, R-3 and R-4*
12. Storage (see Section 311): Groups S-1 and S-2
13. Utility and Miscellaneous (see Section 312): Group U

*[SFM] Existing buildings housing existing protective social care homes or facilities established prior to 1972 (see Section 3413).*

### SECTION 303 ASSEMBLY GROUP A

**303.1 Assembly Group A.** Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation *or motion picture and television production studio sound stages, approved production facilities and production locations.*

**303.1.1 Small buildings and tenant spaces.** A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy.

**303.1.2 Small assembly spaces.** The following rooms and spaces shall not be classified as Assembly occupancies:

1. A room or space used for assembly purposes with an occupant load of less than 50 persons and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
2. A room or space used for assembly purposes that is less than 750 square feet (70 m<sup>2</sup>) in area and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.

**303.1.3 Associated with Group E occupancies.** A room or space used for assembly purposes that is associated with a Group E occupancy is not considered a separate occupancy.

**303.1.4 Accessory to places of religious worship.** Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 are not considered separate occupancies.

**303.2 Assembly Group A-1.** Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:

*Motion picture and television production studio sound stages, approved production facilities and production locations. (with live audiences).*

Motion picture theaters

Symphony and concert halls

Television and radio studios admitting an audience

Theaters

**303.3 Assembly Group A-2.** Assembly uses intended for food and/or drink consumption including, but not limited to:

Banquet halls

Casinos (gaming areas)

Nightclubs

Restaurants, cafeterias and similar dining facilities  
(including associated commercial kitchens)

Taverns and bars

## USE AND OCCUPANCY CLASSIFICATION

**303.4 Assembly Group A-3.** Assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

- Amusement arcades
- Art galleries
- Bowling alleys
- Community halls
- Courtrooms
- Dance halls (not including food or drink consumption)
- Exhibition halls
- Funeral parlors
- Gymnasiums (without spectator seating)
- Indoor swimming pools (without spectator seating)
- Indoor tennis courts (without spectator seating)
- Lecture halls
- Libraries
- Museums
- Places of religious worship
- Pool and billiard parlors
- Waiting areas in transportation terminals

**303.5 Assembly Group A-4.** Assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

- Arenas
- Skating rinks
- Swimming pools
- Tennis courts

**303.6 Assembly Group A-5.** Assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

- Amusement park structures
- Bleachers
- Grandstands
- Stadiums

**303.7 Fixed guideway transit systems.** *[SFM] Fixed guideway transit system buildings shall conform to the requirements of this code for their occupancy classification in addition to the provisions set forth in Section 433.*

**303.8 Subterranean spaces for winery facilities in natural or manmade caves.** *[SFM] For fire and life safety requirements, see Section 436.*

### SECTION 304 BUSINESS GROUP B

**304.1 Business Group B.** Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

- Airport traffic control towers
- Ambulatory care facilities *serving five or fewer patients (see Section 308.3.2 for facilities serving more than five patients)*
- Animal hospitals, kennels and pounds

- Banks
- Barber and beauty shops
- Car wash
- Civic administration
- Clinic, outpatient *[SFM] (not classified as Group I-2.1)*
- Dry cleaning and laundries: pick-up and delivery stations and self-service
- Educational occupancies for students above the 12th grade
- Electronic data processing
- Laboratories: testing, research *and [SFM] instruction*
- Motor vehicle showrooms
- Post offices
- Print shops
- Professional services (architects, attorneys, dentists, physicians, engineers, etc.)
- Radio and television stations
- Telephone exchanges
- Training and skill development not within a school or academic program

**304.2 Definitions.** The following terms are defined in Chapter 2:

**AMBULATORY CARE FACILITY.**

**CLINIC, OUTPATIENT.**

### SECTION 305 EDUCATIONAL GROUP E

**305.1 Educational Group E.** Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, by more *than six* persons at any one time for educational purposes through the 12th grade.

**Exception:** *[SFM] A residence used as a home school for the children who normally reside at the residence. Such residences shall remain classified as Group R-2, or Group R-3 occupancies.*

**305.1.1 Accessory to places of religious worship.** Religious educational rooms and religious auditoriums, which are accessory to places of religious worship in accordance with Section 303.1.4 and have occupant loads of less than 100, shall be classified as Group A-3 occupancies.

**305.2 Group E, day care facilities.** This group includes buildings and structures or portions thereof occupied by more than *six* children 2 years of age *and older* who receive educational, supervision or personal care services for fewer than 24 hours per day.

**Exception:** *[SFM] A Day-care facility not otherwise classified as an R-3 occupancy, where occupants are not capable of responding to an emergency situation without physical assistance from the staff shall be classified as Group I-4.*

### SECTION 306 FACTORY GROUP F

**306.1 Factory Industrial Group F.** Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling,

fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.

### 306.2 Moderate-hazard factory industrial, Group F-1.

Factory industrial uses which are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

- Aircraft (manufacturing, not to include repair)
- Appliances
- Athletic equipment
- Automobiles and other motor vehicles
- Bakeries
- Beverages: over 16-percent alcohol content
- Bicycles
- Boats
- Brooms or brushes
- Business machines
- Cameras and photo equipment
- Canvas or similar fabric
- Carpets and rugs (includes cleaning)
- Clothing
- Construction and agricultural machinery
- Disinfectants
- Dry cleaning and dyeing
- Electric generation plants
- Electronics
- Engines (including rebuilding)
- Food processing and commercial kitchens not associated with restaurants, cafeterias and similar dining facilities
- Furniture
- Hemp products
- Jute products
- Laundries
- Leather products
- Machinery
- Metals
- Millwork (sash and door)
- [SFM] Motion picture and television production studio
- Sound Stages, Approved Production Facilities and production locations (without live audiences)
- Musical instruments
- Optical goods
- Paper mills or products
- Photographic film
- Plastic products
- Printing or publishing
- Recreational vehicles
- Refuse incineration
- Shoes
- Soaps and detergents
- Textiles
- Tobacco
- Trailers
- Upholstering
- Wood; distillation
- Woodworking (cabinet)

**306.3 Low-hazard factory industrial, Group F-2.** Factory industrial uses that involve the fabrication or manufacturing

of noncombustible materials which during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include, but not be limited to, the following:

- Beverages: up to and including 16-percent alcohol content
- Brick and masonry
- Ceramic products
- Foundries
- Glass products
- Gypsum
- Ice
- Metal products (fabrication and assembly)

## SECTION 307 HIGH-HAZARD GROUP H

[F] **307.1 High-hazard Group H.** High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas complying with Section 414, based on the maximum allowable quantity limits for control areas set forth in Tables 307.1(1) and 307.1(2). Hazardous occupancies are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this section, the requirements of Section 415 and the *California Fire Code*. Hazardous materials stored, or used on top of roofs or canopies shall be classified as outdoor storage or use and shall comply with the *California Fire Code*.

**Exceptions:** The following shall not be classified as Group H, but shall be classified as the occupancy that they most nearly resemble.

1. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Section 416 and the *California Fire Code*.
2. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the *California Fire Code*.
3. Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.
4. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 711, or both.
5. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).
6. Liquor stores and distributors without bulk storage.
7. Refrigeration systems.

8. The storage or utilization of materials for agricultural purposes on the premises.
9. Stationary batteries utilized for facility emergency power, uninterruptable power supply or telecommunication facilities, provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with the *California Mechanical Code*.
10. Corrosives shall not include personal or household products in their original packaging used in retail display or commonly used building materials.
11. Buildings and structures occupied for aerosol storage shall be classified as Group S-1, provided that such buildings conform to the requirements of the *California Fire Code*.
12. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with Section 414.2.5.
13. The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements prescribed in the *California Fire Code*.

14. [SFM] Group L occupancies as defined in section 443.1.

[F] **307.1.1 Hazardous materials.** Hazardous materials in any quantity shall conform to the requirements of this code, including Section 414, and the *California Fire Code*.

[F] **307.2 Definitions.** The following terms are defined in Chapter 2:

**AEROSOL.**

Level 1 aerosol products.

Level 2 aerosol products.

Level 3 aerosol products.

**AEROSOL CONTAINER.**

**BALED COTTON.**

**BALED COTTON, DENSELY PACKED.**

**BARRICADE.**

Artificial barricade.

Natural barricade.

**BOILING POINT.**

**CLOSED SYSTEM.**

**COMBUSTIBLE DUST.**

**COMBUSTIBLE FIBERS.**

**COMBUSTIBLE LIQUID.**

Class II.

Class IIIA.

Class IIIB.

**COMPRESSED GAS.**

**CONTROL AREA.**

**CORROSIVE.**

**CRYOGENIC FLUID.**

**DAY BOX.**

**DEFLAGRATION.**

**DETONATION.**

**DISPENSING.**

**EXPLOSION.**

**EXPLOSIVE.**

High explosive.

Low explosive.

Mass-detonating explosives.

UN/DOtn Class 1 explosives.

Division 1.1.

Division 1.2.

Division 1.3.

Division 1.4.

Division 1.5.

Division 1.6.

**FIREWORKS.**

Fireworks, 1.3G.

Fireworks, 1.4G.

**FLAMMABLE GAS.**

**FLAMMABLE LIQUEFIED GAS.**

**FLAMMABLE LIQUID.**

Class IA.

Class IB.

Class IC.

**FLAMMABLE MATERIAL.**

**FLAMMABLE SOLID.**

**FLASH POINT.**

**HANDLING.**

**HAZARDOUS MATERIALS.**

**HEALTH HAZARD.**

**HIGHLY TOXIC.**

**INCOMPATIBLE MATERIALS.**

**INERT GAS.**

**OPEN SYSTEM.**

**OPERATING BUILDING.**

**ORGANIC PEROXIDE.**

Class I.

Class II.

Class III.



Class IV.

Class V.

Unclassified detonable.

**OXIDIZER.**

Class 4.

Class 3.

Class 2.

Class 1.

**OXIDIZING GAS.****PHYSICAL HAZARD.****PYROPHORIC.****PYROTECHNIC COMPOSITION.****TOXIC.****UNSTABLE (REACTIVE) MATERIAL.**

Class 4.

Class 3.

Class 2.

Class 1.

**WATER-REACTIVE MATERIAL.**

Class 3.

Class 2.

Class 1.

**[F] 307.3 High-hazard Group H-1.** Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:

Detonable pyrophoric materials

Explosives:

Division 1.1

Division 1.2

Division 1.3

**[F] TABLE 307.1(1)****MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD<sup>a, j, m, n, p</sup>**

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE <sup>b</sup>			USE-CLOSED SYSTEMS <sup>b</sup>			USE-OPEN SYSTEMS <sup>b</sup>	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible dust	N/A	H-2	Note q	N/A	N/A	Note q	N/A	N/A	Note q	N/A
Combustible liquid <sup>c, i</sup>	II IIIA IIIB	H-2 or H-3 H-2 or H-3 N/A	N/A	120 <sup>d, e</sup> 330 <sup>d, e</sup> 13,200 <sup>e, f</sup>	N/A	N/A	120 <sup>d</sup> 330 <sup>d</sup> 13,200 <sup>f</sup>	N/A	N/A	30 <sup>d</sup> 80 <sup>d</sup> 3,300 <sup>f</sup>
Combustible fiber	Loose Baled <sup>o</sup>	H-3	(100) (1,000)	N/A	N/A	(100) (1,000)	N/A	N/A	(20) (200)	N/A
Consumer fireworks	1.4G	H-3	125 <sup>d, e, l</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cryogenics, flammable	N/A	H-2	N/A	45 <sup>d</sup>	N/A	N/A	45 <sup>d</sup>	N/A	N/A	10 <sup>d</sup>
Cryogenics, inert	N/A	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Cryogenics, oxidizing	N/A	H-3	N/A	45 <sup>d</sup>	N/A	N/A	45 <sup>d</sup>	N/A	N/A	10 <sup>d</sup>
Explosives	Division 1.1	H-1	1 <sup>e, g</sup>	(1) <sup>e, g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>
	Division 1.2	H-1	1 <sup>e, g</sup>	(1) <sup>e, g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>
	Division 1.3	H-1 or H-2	5 <sup>e, g</sup>	(5) <sup>e, g</sup>	N/A	1 <sup>g</sup>	(1) <sup>g</sup>	N/A	1 <sup>g</sup>	(1) <sup>g</sup>
	Division 1.4	H-3	50 <sup>e, g</sup>	(50) <sup>e, g</sup>	N/A	50 <sup>g</sup>	(50) <sup>g</sup>	N/A	N/A	N/A
	Division 1.4G	H-3	125 <sup>d, e, l</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Division 1.5	H-1	1 <sup>e, g</sup>	(1) <sup>e, g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>
	Division 1.6	H-1	1 <sup>d, e, g</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flammable gas	Gaseous Liquefied	H-2	N/A	N/A (150) <sup>d, e</sup>	1,000 <sup>d, e</sup> N/A	N/A	N/A (150) <sup>d, e</sup>	1,000 <sup>d, e</sup> N/A	N/A	N/A
Flammable liquid <sup>c</sup>	1A 1B and 1C	H-2 or H-3	N/A	30 <sup>d, e</sup> 120 <sup>d, e</sup>	N/A	N/A	30 <sup>d</sup> 120 <sup>d</sup>	N/A	N/A	10 <sup>d</sup> 30 <sup>d</sup>
Flammable liquid, combination (1A, 1B, 1C)	N/A	H-2 or H-3	N/A	120 <sup>d, e, h</sup>	N/A	N/A	120 <sup>d, h</sup>	N/A	N/A	30 <sup>d, h</sup>

(continued)

# USE AND OCCUPANCY CLASSIFICATION

[F] TABLE 307.1(1)—(continued)

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD<sup>a, j, m, n, p</sup>

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE <sup>b</sup>			USE-CLOSED SYSTEMS <sup>b</sup>			USE-OPEN SYSTEMS <sup>b</sup>	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Flammable solid	N/A	H-3	125 <sup>d, e</sup>	N/A	N/A	125 <sup>d</sup>	N/A	N/A	25 <sup>d</sup>	N/A
Inert gas	Gaseous	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
	Liquefied	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Organic peroxide	UD	H-1	1 <sup>c, g</sup>	(1) <sup>c, g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>
	I	H-2	5 <sup>d, e</sup>	(5) <sup>d, e</sup>	N/A	1 <sup>d</sup>	(1) <sup>d</sup>	N/A	1 <sup>d</sup>	(1) <sup>d</sup>
	II	H-3	50 <sup>d, e</sup>	(50) <sup>d, e</sup>	N/A	50 <sup>d</sup>	(50) <sup>d</sup>	N/A	10 <sup>d</sup>	(10) <sup>d</sup>
	III	H-3	125 <sup>d, e</sup>	(125) <sup>d, e</sup>	N/A	125 <sup>d</sup>	(125) <sup>d</sup>	N/A	25 <sup>d</sup>	(25) <sup>d</sup>
	IV	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL
	V	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL
Oxidizer	4	H-1	1 <sup>c, g</sup>	(1) <sup>c, g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>	N/A	0.25 <sup>g</sup>	(0.25) <sup>g</sup>
	3 <sup>k</sup>	H-2 or H-3	10 <sup>d, e</sup>	(10) <sup>d, e</sup>	N/A	2 <sup>d</sup>	(2) <sup>d</sup>	N/A	2 <sup>d</sup>	(2) <sup>d</sup>
	2	H-3	250 <sup>d, e</sup>	(250) <sup>d, e</sup>	N/A	250 <sup>d</sup>	(250) <sup>d</sup>	N/A	50 <sup>d</sup>	(50) <sup>d</sup>
	1	N/A	4,000 <sup>e, f</sup>	(4,000) <sup>e, f</sup>	N/A	4,000 <sup>f</sup>	(4,000) <sup>f</sup>	N/A	1,000 <sup>f</sup>	(1,000) <sup>f</sup>
Oxidizing gas	Gaseous	H-3	N/A	N/A	1,500 <sup>d, e</sup>	N/A	N/A	1,500 <sup>d, e</sup>	N/A	N/A
	Liquefied		N/A	(150) <sup>d, e</sup>	N/A	N/A	(150) <sup>d, e</sup>	N/A	N/A	N/A
Pyrophoric material	N/A	H-2	4 <sup>c, g</sup>	(4) <sup>c, g</sup>	50 <sup>c, g</sup>	1 <sup>g</sup>	(1) <sup>g</sup>	10 <sup>g</sup>	0	0
Unstable (reactive)	4	H-1	1 <sup>c, g</sup>	(1) <sup>c, g</sup>	10 <sup>g</sup>	0.25 <sup>g</sup>	(0.25) <sup>g</sup>	2 <sup>c, g</sup>	0.25 <sup>g</sup>	(0.25) <sup>g</sup>
	3	H-1 or H-2	5 <sup>d, e</sup>	(5) <sup>d, e</sup>	50 <sup>d, e</sup>	1 <sup>d</sup>	(1) <sup>d</sup>	10 <sup>d, e</sup>	1 <sup>d</sup>	(1) <sup>d</sup>
	2	H-3	50 <sup>d, e</sup>	(50) <sup>d, e</sup>	250 <sup>d, e</sup>	50 <sup>d</sup>	(50) <sup>d</sup>	250 <sup>d, e</sup>	10 <sup>d</sup>	(10) <sup>d</sup>
	1	N/A	NL	NL	NL	NL	NL	NL	NL	NL
Water reactive	3	H-2	5 <sup>d, e</sup>	(5) <sup>d, e</sup>	N/A	5 <sup>d</sup>	(5) <sup>d</sup>	N/A	1 <sup>d</sup>	(1) <sup>d</sup>
	2	H-3	50 <sup>d, e</sup>	(50) <sup>d, e</sup>	N/A	50 <sup>d</sup>	(50) <sup>d</sup>	N/A	10 <sup>d</sup>	(10) <sup>d</sup>
	1	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL

For SI: 1 cubic foot = 0.028 m<sup>3</sup>, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; N/A = Not Applicable; UD = Unclassified Detonable

a. For use of control areas, see Section 414.2.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. [SFM] In other than Group L occupancies, maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

e. [SFM] In other than Group L occupancies, maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *California Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.

f. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

g. Permitted only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

h. Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.

i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 603.3.2 of the *California Fire Code*.

j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment. Storage containers and the manner of storage shall be approved.

l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.

m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *California Fire Code*.

n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).

o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

p. The following shall not be included in determining the maximum allowable quantities:

1. Liquid or gaseous fuel in fuel tanks on vehicles.
2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with this code.
3. Gaseous fuels in piping systems and fixed appliances regulated by the *California Fuel Gas Code*.
4. Liquid fuels in piping systems and fixed appliances regulated by the *California Mechanical Code*.

q. Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.

**[F] TABLE 307.1(2)**  
**MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD<sup>a, b, c, i</sup>**

MATERIAL	STORAGE <sup>d</sup>			USE-CLOSED SYSTEMS <sup>d</sup>			USE-OPEN SYSTEMS <sup>d</sup>	
	Solid pounds (cubic feet)	Liquid gallons (pounds) <sup>e, f</sup>	Gas (cubic feet at NTP) <sup>e</sup>	Solid pounds <sup>e</sup>	Liquid gallons (pounds) <sup>e</sup>	Gas (cubic feet at NTP) <sup>e</sup>	Solid pounds <sup>e</sup>	Liquid gallons (pounds) <sup>e</sup>
Corrosive	5,000	500	Gaseous 810 <sup>f</sup> Liquefied (150) <sup>h</sup>	5,000	500	Gaseous 810 <sup>f</sup> Liquefied (150) <sup>h</sup>	1,000	100
Highly toxic	10	(10) <sup>h</sup>	Gaseous 20 <sup>g</sup> Liquefied (4) <sup>g, h</sup>	10	(10) <sup>i</sup>	Gaseous 20 <sup>g</sup> Liquefied (4) <sup>g, h</sup>	3	(3) <sup>i</sup>
Toxic	500	(500) <sup>h</sup>	Gaseous 810 <sup>f</sup> Liquefied (150) <sup>f, h</sup>	500	(500) <sup>i</sup>	Gaseous 810 <sup>f</sup> Liquefied (150) <sup>f, h</sup>	125	(125)

For SI: 1 cubic foot = 0.028 m<sup>3</sup>, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- For use of control areas, see Section 414.2.
- In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics, containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
- For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
- The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
- Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note f also applies, the increase for both notes shall be applied cumulatively.
- Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *California Fire Code*. Where Note e also applies, the increase for both notes shall be applied cumulatively.
- Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *California Fire Code*.
- Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.
- For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *California Fire Code*.

Division 1.4

Division 1.5

Division 1.6

Organic peroxides, unclassified detonable

Oxidizers, Class 4

Unstable (reactive) materials, Class 3 detonable and Class 4

**[F] 307.3.1 Occupancies containing explosives not classified as H-1.** The following occupancies containing explosive materials shall be classified as follows:

- Division 1.3 explosive materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.
- Articles, including articles packaged for shipment, that are not regulated as a Division 1.4 explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.

**[F] 307.4 High-hazard Group H-2.** Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids which are used or stored in normally open containers or sys-

tems, or in closed containers or systems pressurized at more than 15 psi (103.4 kPa) gage

Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3

Cryogenic fluids, flammable

Flammable gases

Organic peroxides, Class I

Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103 kPa) gage

Pyrophoric liquids, solids and gases, nondetonable

Unstable (reactive) materials, Class 3, nondetonable

Water-reactive materials, Class 3

**[F] 307.5 High-hazard Group H-3.** Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less

Combustible fibers, other than densely packed baled cotton

Consumer fireworks, 1.4G (Class C, Common)

Cryogenic fluids, oxidizing

Flammable solids

Organic peroxides, Class II and III

Oxidizers, Class 2

## USE AND OCCUPANCY CLASSIFICATION

Oxidizers, Class 3, that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less

Oxidizing gases

Unstable (reactive) materials, Class 2

Water-reactive materials, Class 2

**[F] 307.6 High-hazard Group H-4.** Buildings and structures which contain materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:

Corrosives

Highly toxic materials

Toxic materials

**[F] 307.7 High-hazard Group H-5.** Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.10.

**[F] 307.8 Multiple hazards.** Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

### SECTION 308 INSTITUTIONAL GROUP I

**308.1 Institutional Group I.** Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are not capable of self-preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4. *Restraint shall not be permitted in any building except in Group I-3 occupancies constructed for such use, see Section 408.1.1.*

*Where occupancies house both ambulatory and nonambulatory persons, the more restrictive requirements shall apply.*

**308.2 Definitions.** The following terms are defined in Chapter 2:

**24-HOUR CARE.**

**CUSTODIAL CARE.**

**DETOXIFICATION FACILITIES.**

**FOSTER CARE FACILITIES.**

**HOSPITALS AND PSYCHIATRIC HOSPITALS.**

**INCAPABLE OF SELF-PRESERVATION.**

**MEDICAL CARE.**

**NURSING HOMES.**

**308.3 Institutional Group I-1.** *Not used. (See Group R-2.1 Section 310.1)*

**308.4 Institutional Group I-2.** This occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation *or classified as nonambulatory or bedridden.* This group shall include, but not be limited to, the following:

Foster care facilities

Detoxification facilities

Hospitals

Nursing homes

Psychiatric hospitals

**308.4.2 Institutional Group I-2.1 Ambulatory health care facility.** *A healthcare facility that receives persons for outpatient medical care that may render the patient incapable of unassisted self-preservation and where each tenant space accommodates more than five such patients.*

**308.5 Institutional Group I-3.** This occupancy shall include buildings and structures that are inhabited by *one or more* persons who are under restraint or security. An I-3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control, *which includes persons restrained.* This group shall include, but not be limited to, the following:

Correctional centers

*Courthouse holding facility*

Detention centers

*Detention treatment room*

Jails

Prerelease centers

Prisons

Reformatories

*Secure interview rooms*

*Temporary holding facility*

Buildings of Group I-3 shall be classified as one of the occupancy conditions indicated in Sections 308.5.1 through 308.5.8 (see Section 408.1).

**308.5.1 Condition 1.** This occupancy condition shall include buildings in which free movement is allowed from sleeping areas, and other spaces where access or occupancy is permitted, to the exterior via means of egress without restraint. A Condition 1 facility is permitted to be constructed as Group R.

**308.5.2 Condition 2.** This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments. Egress to the exterior is impeded by locked exits.

**308.5.3 Condition 3.** This occupancy condition shall include buildings in which free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping units and group activity spaces, where egress is impeded by remote-controlled release of means of egress from such a smoke compartment to another smoke compartment.

**308.5.4 Condition 4.** This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from sleeping units, activity

spaces and other occupied areas within the smoke compartment to other smoke compartments.

**308.5.5 Condition 5.** This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

**308.5.6 Condition 6.** *This occupancy condition shall include buildings containing only one temporary holding facility with five or less persons under restraint or security where the building is protected throughout with a monitored automatic sprinkler system installed in accordance with Section 903.3.1.1 and where the temporary holding facility is protected throughout with an automatic fire alarm system with notification appliances. A Condition 6 building shall be permitted to be classified as a Group B occupancy.*

**308.5.7 Condition 7.** *This occupancy condition shall include buildings containing only one temporary holding facility with nine or less persons under restraint or security where limited to the first or second story, provided the building complies with Section 408.1.2.6. A Condition 7 building shall be permitted to be classified as a Group B occupancy.*

**308.5.8 Condition 8.** *This occupancy condition shall include buildings containing not more than four secure interview rooms located within the same fire area where not more than six occupants under restraint are located in the same fire area. A Condition 8 building shall be permitted to be classified as a Group B occupancy, provided the requirements in Section 408.1.2.7 are met.*

**308.6 Institutional Group I-4, day care facilities.** This group shall include buildings and structures occupied by more than six clients of any age who receive custodial care for fewer than 24 hours per day by persons other than parents or guardians, relatives by blood, marriage or adoption, and in a place other than the home of the clients cared for. This group shall include, but not be limited to, the following:

- Adult day care
- Child day care

**308.6.1 Classification as Group E.** A child day care facility that provides care for more than six but no more than 100 children under 2 years of age, where the rooms in which the children are cared for are located on a level of exit discharge serving such rooms and each of these child care rooms has an exit door directly to the exterior, shall be classified as Group E.

**308.6.1.1 Special provisions.** See Section 442.4 for daycares located above or below the first story.

## SECTION 309 MERCANTILE GROUP M

**309.1 Mercantile Group M.** Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof, for the display and sale of merchandise and

involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following:

- Department stores
- Drug stores
- Markets
- Motor fuel-dispensing facilities
- Retail or wholesale stores
- Sales rooms

**309.2 Quantity of hazardous materials.** The aggregate quantity of nonflammable solid and nonflammable or non-combustible liquid hazardous materials stored or displayed in a single control area of a Group M occupancy shall not exceed the quantities in Table 414.2.5(1).

## SECTION 310 RESIDENTIAL GROUP R

**310.1 Residential Group R.** Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *California Residential Code*.

**310.2 Definitions.** The following terms are defined in Chapter 2:

- AGED HOME OR INSTITUTION.
- BEDRIDDEN PERSON.
- BOARDING HOUSE.
- CARE AND SUPERVISION.
- CATASTROPHICALLY INJURED.
- CHILD-CARE CENTER.
- CHILD OR CHILDREN.
- CHRONICALLY ILL.
- CONGREGATE LIVING HEALTH FACILITY (CLHF).
- CONGREGATE RESIDENCE.
- DAY CARE.
- DAY-CARE HOME, FAMILY.
- DAY-CARE HOME, LARGE FAMILY.
- DAY-CARE HOME, SMALL FAMILY.
- DORMITORY.
- FULL-TIME CARE.
- GROUP HOME.
- INFANT.
- MENTALLY RETARDED PERSONS, PROFOUNDLY OR SEVERELY.
- NONAMBULATORY PERSONS.
- RESIDENTIAL CARE FACILITY FOR THE CHRONICALLY ILL (RCF/CI).
- RESIDENTIAL CARE FACILITY FOR THE ELDERLY (RCFE).
- RESIDENTIAL FACILITY (RF).
- TERMINALLY ILL.
- TRANSIENT.

**310.3 Residential Group R-1.** Residential occupancies containing sleeping units where the occupants are primarily transient in nature, including:

Boarding houses (transient) with more than 10 occupants  
*Congregate residents* (transient) with more than 10 occupants  
 Hotels (transient)  
 Motels (transient)

**[HCD 1] Efficiency dwelling units (transient)**

**310.4 Residential Group R-2.** Residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including:

Apartment houses  
 Boarding houses (nontransient) with more than 16 occupants  
*Congregate residences* (nontransient) with more than 16 occupants  
 Convents  
 Dormitories  
 Fraternities and sororities  
 Hotels (nontransient)  
 Live/work units  
 Monasteries  
 Motels (nontransient)  
 Vacation timeshare properties

**[HCD 1] Efficiency dwelling units (nontransient)**

**310.4.1 Residential Group R-2.1** This occupancy shall include buildings, structures or parts thereof housing clients, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment that provides personal care services.

This occupancy may contain more than six nonambulatory and/or bedridden clients. (See Section 425 Special Provisions for Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 Occupancy). This group shall include, but not be limited to, the following:

Assisted living facilities such as:  
*Residential care facilities,*  
*Residential care facilities for the elderly (RCFEs),*  
*Adult residential facilities,*  
*Congregate living health facilities,*  
*Group homes,*  
*Residential care facilities for the chronically ill,*  
*Congregate living health facilities for the terminally ill.*  
 Social rehabilitation facilities such as:  
*Halfway houses,*  
*Community correctional centers,*  
*Community correction reentry centers,*  
*Community treatment programs,*  
*Work furlough programs,*  
*Alcoholism or drug abuse recovery or treatment facilities.*

**310.5 Residential Group R-3.** Residential occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-2.1, R-3.1, R-4 or I, including:

Buildings that do not contain more than two dwelling units  
 Boarding houses (nontransient) with 16 or fewer

occupants  
 Boarding houses (transient) with 10 or fewer occupants  
 Adult care facilities that provide accommodations for six or fewer clients of any age for less than 24 hours. *Licensing categories that may use this classification include, but are not limited to:*

*Adult Day Programs.*

*Child care facilities that provide accommodations for six or fewer clients of any age for less than 24 hours. Licensing categories that may use this classification include, but are not limited to:*

*Day-Care Center for Mildly Ill Children,*  
*Infant Care Center,*  
*School Age Child Day-Care Center.*

*Congregate residences* (nontransient) with 16 or fewer occupants  
*Congregate residences* (transient) with 10 or fewer occupants

**[HCD 1] Efficiency dwelling units**

*Family Day-Care Homes that provide accommodations for 14 or fewer children, in the provider's own home for less than 24-hours.*

*Alcoholism or drug abuse recovery homes (ambulatory only)*  
*Foster family homes (ambulatory only)*

Adult care and child care facilities that are within a single family home are permitted to comply with the California Residential Code.

**310.5.1 Residential Group R-3.1** This occupancy group may include facilities licensed by a governmental agency for a residentially based 24-hour care facility providing accommodations for six or fewer clients of any age. Clients may be classified as ambulatory, nonambulatory or bedridden. A Group R-3.1 occupancy shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in Section 425 Special Provisions For Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 Occupancy. This group may include:

*Adult residential facilities*  
*Congregate living health facilities*  
*Foster family homes*  
*Group homes*  
*Intermediate care facilities for the developmentally disabled habilitative*  
*Intermediate care facilities for the developmentally disabled nursing*  
*Nurseries for the full-time care of children under the age of six, but not including "infants" as defined in Section 310*  
*Residential care facilities for the elderly*  
*Small family homes and residential care facilities for the chronically ill*

**Exception:** Group Homes licensed by the Department of Social Services which provide nonmedical board, room and care for six or fewer ambulatory children or

*children two years of age or younger, and which do not have any nonambulatory clients shall not be subject to regulations found in Section 425.*

*Pursuant to Health and Safety Code Section 13143 with respect to these exempted facilities, no city, county or public district shall adopt or enforce any requirement for the prevention of fire or for the protection of life and property against fire and panic unless the requirement would be applicable to a structure regardless of the special occupancy. Nothing shall restrict the application of state or local housing standards to such facilities if the standards are applicable to residential occupancies and are not based on the use of the structure as a facility for ambulatory children. For the purpose of this exception, ambulatory children does not include relatives of the licensee or the licensee's spouse.*

**310.6 Residential Group R-4.** This occupancy shall include buildings, structures or portions thereof for more than six ambulatory clients, but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised residential environment and receive custodial care. The persons receiving care are capable of self-preservation. This group shall include, but not be limited to, the following:

*This occupancy classification may include a maximum six nonambulatory or bedridden clients (see Section 425 Special Provisions for Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 Occupancy). Group R-4 occupancies shall include the following:*

*Assisted living facilities such as:  
Residential care facilities,  
Residential care facilities for the elderly (RCFE),  
Adult residential facilities,  
Congregate living health facilities,  
Group homes.*

*Social rehabilitation facilities such as:  
Halfway houses,  
Community correctional centers,  
Community correction reentry centers,  
Community treatment programs,  
Work furlough programs,  
Alcoholism or drug abuse recovery or treatment facilities.*

Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in this code.

**310.7 Large Family Day-Care Homes.** See Section 445.

## SECTION 311 STORAGE GROUP S

**311.1 Storage Group S.** Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

**311.2 Moderate-hazard storage, Group S-1.** Buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

Aerosols, Levels 2 and 3  
Aircraft hangar (storage and repair)  
Bags: cloth, burlap and paper  
Bamboos and rattan  
Baskets  
Belting: canvas and leather  
Books and paper in rolls or packs  
Boots and shoes  
Buttons, including cloth covered, pearl or bone  
Cardboard and cardboard boxes  
Clothing, woolen wearing apparel  
Cordage  
Dry boat storage (indoor)  
Furniture  
Furs  
Glues, mucilage, pastes and size  
Grains  
Horns and combs, other than celluloid  
Leather  
Linoleum  
Lumber  
Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials listed in Table 307.1(1) (see Section 406.8)  
Photo engravings  
Resilient flooring  
Silks  
Soaps  
Sugar  
Tires, bulk storage of  
Tobacco, cigars, cigarettes and snuff  
Upholstery and mattresses  
Wax candles

**311.3 Low-hazard storage, Group S-2.** Includes, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Group S-2 storage uses shall include, but not be limited to, storage of the following:

Asbestos  
Beverages up to and including 16-percent alcohol in metal, glass or ceramic containers  
Cement in bags  
Chalk and crayons  
Dairy products in nonwaxed coated paper containers  
Dry cell batteries  
Electrical coils  
Electrical motors  
Empty cans  
Food products  
Foods in noncombustible containers  
Fresh fruits and vegetables in nonplastic trays or containers  
Frozen foods  
Glass  
Glass bottles, empty or filled with noncombustible liquids  
Gypsum board  
Inert pigments

## USE AND OCCUPANCY CLASSIFICATION

Ivory  
Meats  
Metal cabinets  
Metal desks with plastic tops and trim  
Metal parts  
Metals  
Mirrors  
Oil-filled and other types of distribution transformers  
Parking garages, open or enclosed  
Porcelain and pottery  
Stoves  
Talc and soapstones  
Washers and dryers

### SECTION 312

#### UTILITY AND MISCELLANEOUS GROUP U

**312.1 General.** Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

Agricultural buildings  
Aircraft hangars, accessory to a one- or two-family residence (see Section 412.5)  
Barns  
Carports  
Fences more than 6 feet (1829 mm) in height  
Grain silos, accessory to a residential occupancy  
Greenhouses  
Livestock shelters  
Private garages  
Retaining walls  
Sheds  
Stables  
Tanks  
Towers

### SECTION 313

#### LABORATORIES GROUP L [SFM]

**313.1 Laboratories Group L. [SFM]** Group L occupancy includes the use of a building or structure, or a portion thereof, containing one or more laboratory suites as defined in Section 443.



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS ON USE AND OCCUPANCY

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X									X			X		
Chapter / Section																				
403		X																		
403.1		X																		
403.1.1		X																		
403.2		X																		
403.2.1		X																		
403.2.1.1		X																		
403.3		X																		
403.3.1		X																		
403.3.2		X																		
403.3.2.1		X																		
403.3.4		X																		
403.4.4		X																		
403.4.6		X																		
403.4.6.1		X																		
403.4.7		X																		
403.4.7.1		X																		
403.4.8.1		X																		
403.5.3		X																		
403.5.4		X																		
403.6		X																		
403.7		X																		
404.2		X																		
404.6		X																		
404.10		X																		
406.3.5			X	X																
406.4.1			X	X	X	X														
406.6.2		X																		
406.9		X																		
406.9.1		X																		
406.9.2		X																		
406.9.3		X																		
406.9.4		X																		
407.1		X																		
407.2		X																		
407.2.1		X																		
407.2.2		X																		
407.3		X																		
407.3.1		X																		
407.3.1.1		X																		
407.3.2		X																		
407.4.1.2		X																		
407.4.3.2		X																		
407.5		X																		

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS ON USE AND OCCUPANCY—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X									X			X		
Chapter / Section																				
407.5.2		X																		
407.6		X																		
407.6.1		X																		
407.8		X																		
407.9		X																		
407.11		X																		
407.11.1		X																		
407.11.2		X																		
407.11.3		X																		
407.11.4		X																		
408.1.1		X																		
408.1.2		X																		
408.1.2.1		X																		
408.1.2.2		X																		
408.1.2.3		X																		
408.1.2.4		X																		
408.1.2.5		X																		
408.1.2.6		X																		
408.1.2.7		X																		
408.2		X																		
408.2.1		X																		
408.3.1.1		X																		
408.3.6		X																		
408.3.6.1		X																		
408.3.6.2		X																		
408.3.6.4		X																		
408.3.6.5		X																		
408.3.8		X																		
408.3.8.1		X																		
408.3.8.2		X																		
408.3.9		X																		
408.3.10		X																		
408.3.11		X																		
408.4		X																		
408.4.3		X																		
408.5.1		X																		
408.6		X																		
408.6.1		X																		
408.8		X																		
408.8.1		X																		
408.9		X																		
408.9.1		X																		

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS ON USE AND OCCUPANCY—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X									X			X		
Chapter / Section																				
408.12		X																		
408.13		X																		
408.14		X																		
408.15		X																		
408.15.1		X																		
408.15.2		X																		
408.15.3		X																		
408.15.3.1		X																		
408.15.3.2		X																		
408.15.4		X																		
408.15.5		X																		
409.3		X																		
> 412.3.5						X														
412.6.6		X																		
414.1.1		X																		
414.1.2		X																		
414.1.2.1		X																		
414.2		X																		
414.3		X																		
414.5		X																		
Table 414.5.1		X																		
414.5.5		X																		
415.1		X																		
415.5		X																		
> 415.5.1		X																		
Table 415.5.2		X																		
415.8		X																		
415.8.1		X																		
415.8.1.4		X																		
415.8.2		X																		
415.8.2.3		X																		
415.8.2.4		X																		
415.8.2.6		X																		
415.8.2.7		X																		
415.8.2.8		X																		
415.8.3		X																		
415.8.4		X																		
415.9		X																		
415.10		X																		
415.10.1.7		X																		
415.10.4		X																		

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS ON USE AND OCCUPANCY—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X									X			X		
Chapter / Section																				
415.10.7.2		X																		
415.10.9.3		X																		
415.10.10.1		X																		
415.10.11		X																		
415.11		X																		
415.11.1		X																		
415.11.1.1		X																		
415.11.1.2		X																		
415.11.1.3		X																		
415.11.1.4		X																		
415.11.1.5		X																		
415.12		X																		
415.12.1		X																		
415.12.2		X																		
415.12.3		X																		
416.1		X																		
416.3		X																		
416.4		X																		
419.7		X			X															
419.9		X	X	X	X															
420.1		X																		
420.6		X	X	X	X															
420.6.1		X	X	X	X															
420.6.1.1		X	X	X	X															
420.6.1.2		X	X	X	X															
420.6.1.3		X	X	X	X															
420.6.1.4		X	X	X	X															
420.6.1.5		X	X	X	X															
420.6.1.6		X	X	X	X															
420.6.2		X	X	X	X															
420.6.2.1		X	X	X	X															
420.6.2.2		X	X	X	X															
420.6.2.3		X	X	X	X															
420.6.2.3.1		X	X	X	X															
420.6.2.3.2		X	X	X	X															
420.6.2.4		X	X	X	X															
420.6.2.5		X	X	X	X															
420.6.2.6		X	X	X	X															
420.7		X	X	X	X															
420.8		X	X		X															
420.8.1		X	X	X	X															

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS ON USE AND OCCUPANCY—continued**

Adopting Agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X	X	X		X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X																
<i>Adopt only those sections that are listed below</i>						X									X			X		
<i>Chapter / Section</i>																				
420.9		X																		
420.10		X																		
421.1		X																		
421.5		X																		
421.7		X																		
425		X																		
426		X																		
430		X																		
431		X																		
432		X																		
433		X																		
434		X																		
436		X																		
439		X																	X	
440		X													X					
442		X																		
443		X																		
445		X																		



## CHAPTER 4

# SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

### SECTION 401 SCOPE

**401.1 Detailed use and occupancy requirements.** In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the special uses and occupancies described herein.

### SECTION 402 COVERED MALL AND OPEN MALL BUILDINGS

*Section 402 has been completely reorganized from the 2009 code; therefore, the \* and \*\* margin indicators have not been included for clarity.*

**402.1 Applicability.** The provisions of this section shall apply to buildings or structures defined herein as covered or open mall buildings not exceeding three floor levels at any point nor more than three stories above grade plane. Except as specifically required by this section, covered and open mall buildings shall meet applicable provisions of this code.

#### Exceptions:

1. Foyers and lobbies of Groups B, R-1 and R-2 are not required to comply with this section.
2. Buildings need not comply with the provisions of this section where they totally comply with other applicable provisions of this code.

**402.1.1 Open space.** A covered mall building and attached anchor buildings and parking garages shall be surrounded on all sides by a permanent open space or not less than 60 feet (18 288 mm). An open mall building and anchor buildings and parking garages adjoining the perimeter line shall be surrounded on all sides by a permanent open space of not less than 60 feet (18 288 mm).

**Exception:** The permanent open space of 60 feet (18 288 mm) shall be permitted to be reduced to not less than 40 feet (12 192 mm), provided the following requirements are met:

1. The reduced open space shall not be allowed for more than 75 percent of the perimeter of the covered or open mall building and anchor buildings;
2. The exterior wall facing the reduced open space shall have a fire-resistance rating of not less than 3 hours;
3. Openings in the exterior wall facing the reduced open space shall have opening protectives with a fire protection rating of not less than 3 hours; and
4. Group E, H, I or R occupancies are not located within the covered or open mall building or anchor buildings.

**402.1.2 Open mall building perimeter line.** For the purpose of this code, a perimeter line shall be established. The perimeter line shall encircle all buildings and structures which comprise the open mall building and shall encompass any open-air interior walkways, open-air courtyards or similar open-air spaces. The perimeter line shall define the extent of the open mall building. Anchor buildings and parking structures shall be outside of the perimeter line and are not considered as part of the open mall building.

**402.2 Definitions.** The following terms are defined in Chapter 2:

**ANCHOR BUILDING.**

**COVERED MALL BUILDING.**

**Mall.**

**Open mall.**

**Open mall building.**

**FOOD COURT.**

**GROSS LEASABLE AREA.**

**402.3 Lease plan.** Each owner of a covered mall building or of an open mall building shall provide both the building and fire departments with a lease plan showing the location of each occupancy and its exits after the certificate of occupancy has been issued. No modifications or changes in occupancy or use shall be made from that shown on the lease plan without prior approval of the building official.

**402.4 Construction.** The construction of covered and open mall buildings, anchor buildings and parking garages associated with a mall building shall comply with Sections 402.4.1 through 402.4.3.

**402.4.1 Area and types of construction.** The building area of any covered mall or open building, including anchor buildings, of Types I, II, III and IV construction shall not be limited provided the anchor buildings do not exceed three stories above grade plane.

The construction type of open parking garages and enclosed parking garages shall comply with Sections 406.5 and 406.6, respectively.

**Exception:** The type of construction allowable building height and building area of anchor buildings greater than three stories above grade plane shall comply with Section 503, as modified by Sections 504 and 506.

**402.4.2 Fire-resistance-rated separation.** Fire-resistance-rated separation is not required between tenant spaces and the mall. Fire-resistance-rated separation is not required between a food court and adjacent tenant spaces or the mall.

**402.4.2.1 Tenant separations.** Each tenant space shall be separated from other tenant spaces by a fire partition complying with Section 708. A tenant separation wall is not required between any tenant space and the mall.

**402.4.2.2 Anchor building separation.** An anchor building shall be separated from the covered or open mall building by fire walls complying with Section 706.

**Exceptions:**

1. Anchor buildings of not more than three stories above grade plane that have an occupancy classification the same as that permitted for tenants of the mall building shall be separated by 2-hour fire-resistance-rated fire barriers complying with Section 707.
2. The exterior walls of anchor buildings separated from an open mall building by an open mall shall comply with Table 602.

**402.4.2.2.1 Openings between anchor building and mall.** Except for the separation between Group R-1 sleeping units and the mall, openings between anchor buildings of Type IA, IB, IIA or IIB construction and the mall need not be protected.

**402.4.2.3 Parking garages.** An attached garage for the storage of passenger vehicles having a capacity of not more than nine persons and open parking garages shall be considered as a separate building where it is separated from the covered or open mall building or anchor building by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

Parking garages, open or enclosed, which are separated from covered mall buildings, open mall buildings or anchor buildings shall comply with the provisions of Table 602.

Pedestrian walkways and tunnels which connect garages to mall buildings or anchor buildings shall be constructed in accordance with Section 3104.

**402.4.3 Open mall construction.** Floor assemblies in, and roof assemblies over, the open mall of an open mall building shall be open to the atmosphere for not less than 20 feet (9096 mm), measured perpendicular from the face of the tenant spaces on the lowest level, from edge of balcony to edge of balcony on upper floors and from edge of roof line to edge of roof line. The openings within, or the unroofed area of, an open mall shall extend from the lowest/grade level of the open mall through the entire roof assembly. Balconies on upper levels of the mall shall not project into the required width of the opening.

**402.4.3.1 Pedestrian walkways.** Pedestrian walkways connecting balconies in an open mall shall be located not less than 20 feet (9096 mm) from any other pedestrian walkway.

**[F] 402.5 Automatic sprinkler system.** Covered and open mall buildings and buildings connected shall be protected

throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, which shall comply with the all of the following:

1. The automatic sprinkler system shall be complete and operative throughout occupied space in the mall building prior to occupancy of any of the tenant spaces. Unoccupied tenant spaces shall be similarly protected unless provided with approved alternative protection.
2. Sprinkler protection for the mall of a covered mall building shall be independent from that provided for tenant spaces or anchor buildings.
3. Sprinkler protection for the tenant spaces of an open mall building shall be independent from that provided for anchor buildings.
4. Sprinkler protection shall be provided beneath exterior circulation balconies located adjacent to an open mall.
5. Where tenant spaces are supplied by the same system, they shall be independently controlled.

**Exception:** An automatic sprinkler system shall not be required in spaces or areas of open parking garages separated from the covered or open mall building in accordance with Section 402.4.2.3 and constructed in accordance with Section 406.5.

**402.6 Interior finishes and features.** Interior finishes within the mall and installations within the mall shall comply with Sections 402.6.1 through 402.6.4.

**402.6.1 Interior finish.** Interior wall and ceiling finishes within the mall of a covered mall building and within the exits of covered or open mall buildings shall have a minimum flame spread index and smoke-developed index of Class B in accordance with Chapter 8. Interior floor finishes shall meet the requirements of Section 804.

**402.6.2 Kiosks.** Kiosks and similar structures (temporary or permanent) located within the mall of a covered mall building or within the perimeter line of an open mall building shall meet the following requirements:

1. Combustible kiosks or other structures shall not be located within a covered or open mall unless constructed of any of the following materials:
  - 1.1. Fire-retardant-treated wood complying with Section 2303.2.
  - 1.2. Foam plastics having a maximum heat release rate not greater than 100 kW (105 Btu/h) when tested in accordance with the exhibit booth protocol in UL 1975 or when tested in accordance with NFPA 289 using the 20 kW ignition source.
  - 1.3. Aluminum composite material (ACM) meeting the requirements of Class A interior finish in accordance with Chapter 8 when tested as an assembly in the maximum thickness intended.
2. Kiosks or similar structures located within the mall shall be provided with approved automatic sprinkler system and detection devices.



3. The horizontal separation between kiosks or groupings thereof and other structures within the mall shall be not less than 20 feet (6096 mm).
4. Each kiosk or similar structure or groupings thereof shall have an area not greater than 300 square feet (28 m<sup>2</sup>).

**402.6.3 Children's play structures.** Children's play structures located within the mall of a covered mall building or within the perimeter line of an open mall building shall comply with Section 424. The horizontal separation between children's play structures, kiosks and similar structures within the mall shall be not less than 20 feet (6096 mm).

**402.6.4 Plastic signs.** Plastic signs affixed to the storefront of any tenant space facing a mall or open mall shall be limited as specified in Sections 402.6.4.1 through 402.6.4.5.

**402.6.4.1 Area.** Plastic signs shall be not more than 20 percent of the wall area facing the mall.

**402.6.4.2 Height and width.** Plastic signs shall be not greater than 36 inches (914 mm) in height, except that if the sign is vertical, the height shall be not greater than 96 inches (2438 mm) and the width shall be not greater than 36 inches (914 mm).

**402.6.4.3 Location.** Plastic signs shall be located not less than 18 inches (457 mm) from adjacent tenants.

**402.6.4.4 Plastics other than foam plastics.** Plastics other than foam plastics used in signs shall be light-transmitting plastics complying with Section 2606.4 or shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929, and a flame spread index not greater than 75 and smoke-developed index not greater than 450 when tested in the manner intended for use in accordance with ASTM E 84 or UL 723 or meet the acceptance criteria of Section 803.1.2.1 when tested in accordance with NFPA 286.

**402.6.4.4.1 Encasement.** Edges and backs of plastic signs in the mall shall be fully encased in metal.

**402.6.4.5 Foam plastics.** Foam plastics used in signs shall have flame-retardant characteristics such that the sign has a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289 using the 20 kW ignition source, and the foam plastics shall have the physical characteristics specified in this section. Foam plastics used in signs installed in accordance with Section 402.6.4 shall not be required to comply with the flame spread and smoke-developed indices specified in Section 2603.3.

**402.6.4.5.1 Density.** The density of foam plastics used in signs shall be not less than 20 pounds per cubic foot (pcf) (320 kg/m<sup>3</sup>).

**402.6.4.5.2 Thickness.** The thickness of foam plastic signs shall not be greater than 1/2 inch (12.7 mm).

**[F] 402.7 Emergency systems.** Covered and open mall buildings, anchor buildings and associated parking garages shall be provided with emergency systems complying with Sections 402.7.1 through 402.7.5.

**[F] 402.7.1 Standpipe system.** Covered and open mall buildings shall be equipped throughout with a standpipe system as required by Section 905.3.3.

**[F] 402.7.2 Smoke control.** Where a covered mall building contains an atrium, a smoke control system shall be provided in accordance with Section 404.5.

**Exception:** A smoke control system is not required in covered mall buildings where an atrium connects only two stories.

**[F] 402.7.3 Standby power.** Covered mall buildings greater than 50,000 square feet (4645 m<sup>2</sup>) in area and open mall buildings greater than 50,000 square feet (4645 m<sup>2</sup>) within the established perimeter line shall be provided with standby power systems that are capable of operating the emergency voice/alarm communication system.

**[F] 402.7.4 Emergency voice/alarm communication system.** Where the total floor area is greater than 50,000 square feet (4645 m<sup>2</sup>) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/alarm communication system shall be provided.

Emergency voice/alarm communication systems serving a mall, required or otherwise, shall be accessible to the fire department. The systems shall be provided in accordance with Section 907.5.2.2.

**[F] 402.7.5 Fire department access to equipment.** Rooms or areas containing controls for air-conditioning systems, automatic fire-extinguishing systems, automatic sprinkler systems or other detection, suppression or control elements shall be identified for use by the fire department.

**402.8 Means of egress.** Covered mall buildings, open mall buildings and each tenant space within a mall building shall be provided with means of egress as required by this section and this code. Where there is a conflict between the requirements of this code and the requirements of Sections 402.8.1 through 402.8.8, the requirements of Sections 402.8.1 through 402.8.8 shall apply.

**402.8.1 Mall width.** For the purpose of providing required egress, malls are permitted to be considered as corridors but need not comply with the requirements of Section 1005.1 of this code where the width of the mall is as specified in this section.

**402.8.1.1 Minimum width.** The aggregate clear egress width of the mall in either a covered or open mall building shall be not less than 20 feet (6096 mm). The mall width shall be sufficient to accommodate the occupant load served. No portion of the minimum required aggregate egress width shall be less than 10 feet (3048 mm) measured to a height of 8 feet (2438 mm) between any projection of a tenant space bordering the mall and the nearest kiosk, vending machine, bench, display

opening, food court or other obstruction to means of egress travel.

**402.8.2 Determination of occupant load.** The occupant load permitted in any individual tenant space in a covered or open mall building shall be determined as required by this code. Means of egress requirements for individual tenant spaces shall be based on the occupant load thus determined.

**402.8.2.1 Occupant formula.** In determining required means of egress of the mall, the number of occupants for whom means of egress are to be provided shall be based on gross leasable area of the covered or open mall building (excluding anchor buildings) and the occupant load factor as determined by Equation 4-1.

$$OLF = (0.00007) (GLA) + 25 \quad (\text{Equation 4-1})$$

where:

*OLF* = The occupant load factor (square feet per person).

*GLA* = The gross leasable area (square feet).

**Exception:** Tenant spaces attached to a covered or open mall building but with a means of egress system that is totally independent of the open mall of an open mall building or of a covered mall building shall not be considered as gross leasable area for determining the required means of egress for the mall building.

**402.8.2.2 OLF range.** The occupant load factor (OLF) is not required to be less than 30 and shall not exceed 50.

**402.8.2.3 Anchor buildings.** The occupant load of anchor buildings opening into the mall shall not be included in computing the total number of occupants for the mall.

**402.8.2.4 Food courts.** The occupant load of a food court shall be determined in accordance with Section 1004. For the purposes of determining the means of egress requirements for the mall, the food court occupant load shall be added to the occupant load of the covered or open mall building as calculated above.

**402.8.3 Number of means of egress.** Wherever the distance of travel to the mall from any location within a tenant space used by persons other than employees is greater than 75 feet (22 860 mm) or the tenant space has an occupant load of 50 or more, no fewer than two means of egress shall be provided.

**402.8.4 Arrangements of means of egress.** Assembly occupancies with an occupant load of 500 or more located within a covered mall building shall be so located such that their entrance will be immediately adjacent to a principal entrance to the mall and shall have not less than one-half of their required means of egress opening directly to the exterior of the covered mall building. Assembly occupancies located within the perimeter line of an open mall building shall be permitted to have their main exit open to the open mall.

**402.8.4.1 Anchor building means of egress.** Required means of egress for anchor buildings shall be provided independently from the mall means of egress system. The occupant load of anchor buildings opening into the mall shall not be included in determining means of egress requirements for the mall. The path of egress travel of malls shall not exit through anchor buildings. Malls terminating at an anchor building where no other means of egress has been provided shall be considered as a dead-end mall.

**402.8.5 Distance to exits.** Within each individual tenant space in a covered or open mall building, the distance of travel from any point to an exit or entrance to the mall shall be not greater than 200 feet (60 960 mm).

The distance of travel from any point within a mall of a covered mall building to an exit shall be not greater than 200 feet (60 960 mm). The maximum distance of travel from any point within an open mall to the perimeter line of the open mall building shall be not greater than 200 feet (60 960 mm).

**402.8.6 Access to exits.** Where more than one exit is required, they shall be so arranged that it is possible to travel in either direction from any point in a mall of a covered mall building to separate exits or from any point in an open mall of an open mall building to two separate locations on the perimeter line, provided neither location is an exterior wall of an anchor building or parking garage. The width of an exit passageway or corridor from a mall shall be not less than 66 inches (1676 mm).

**Exception:** Access to exits are permitted by way of a dead-end mall which does not exceed a length equal to twice the width of the mall measured at the narrowest location within the dead-end portion of the mall.

**402.8.6.1 Exit passageways.** Where exit passageways provide a secondary means of egress from a tenant space, doorways to the exit passageway shall be protected by 1-hour fire door assemblies that are self- or automatic-closing by smoke detection in accordance with Section 716.5.9.3.

**402.8.7 Service areas fronting on exit passageways.** Mechanical rooms, electrical rooms, building service areas and service elevators are permitted to open directly into exit passageways, provided the exit passageway is separated from such rooms with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire protection rating of openings in the fire barriers shall be not less than 1 hour.

**402.8.8 Security grilles and doors.** Horizontal sliding or vertical security grilles or doors that are a part of a required means of egress shall conform to the following:

1. They shall remain in the full open position during the period of occupancy by the general public.
2. Doors or grilles shall not be brought to the closed position when there are 10 or more persons occupying spaces served by a single exit or 50 or more persons occupying spaces served by more than one exit.

3. The doors or grilles shall be openable from within without the use of any special knowledge or effort where the space is occupied.
4. Where two or more exits are required, not more than one-half of the exits shall be permitted to include either a horizontal sliding or vertical rolling grille or door.

**SECTION 403**  
**HIGH-RISE BUILDINGS AND GROUP I-2**  
**OCCUPANCIES HAVING OCCUPIED**  
**FLOORS LOCATED MORE THAN 75 FEET**  
**ABOVE THE LOWEST LEVEL OF FIRE**  
**DEPARTMENT VEHICLE ACCESS**

**403.1 Applicability.** *New high-rise buildings and new Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall comply with Sections 403.2 through 403.6.*

**Exception:** The provisions of Sections 403.2 through 403.6 shall not apply to the following buildings and structures:

1. Airport traffic control towers in accordance with Section 412.3.
2. Open parking garages in accordance with Section 406.5.
3. Buildings with a Group A-5 occupancy in accordance with Section 303.6.
4. Special industrial occupancies in accordance with Section 503.1.1.
5. *Buildings such as power plants, lookout towers, steeples, grain houses and similar structures with noncontinuous human occupancy, when so determined by the enforcing agency.*

*For existing high-rise buildings, see Section 3414 and for existing Group R occupancies, see Section 3413.13.*

*For the purpose of this section, in determining the level from which the highest occupied floor is to be measured, the enforcing agency should exercise reasonable judgment, including consideration of overall accessibility to the building by fire department personnel and vehicular equipment. When a building is located on sloping terrain and there is building access on more than one level, the enforcing agency may select the level that provides the most logical and adequate fire department access.*

**403.1.1 Definitions.** *The following terms are defined in Chapter 2.*

*HIGH-RISE BUILDING.*

*HIGH-RISE BUILDING ACCESS.*

*NEW HIGH-RISE BUILDING.*

**403.2 Construction.** The construction of high-rise buildings shall comply with the provisions of Sections 403.2.1 through 403.2.4.

**403.2.1 Reduction in fire-resistance rating.** The fire-resistance-rating reductions listed in Sections 403.2.1.1

and 403.2.1.2 shall be allowed in buildings that have sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

**Exception:** *Buildings, or portions of buildings, classified as a Group H-1, H-2 or H-3 occupancy.*

**403.2.1.1 Type of construction.** The following reductions in the minimum fire-resistance rating of the building elements in Table 601 shall be permitted as follows:

1. For buildings not greater than 420 feet (128 000 mm) in building height, the fire-resistance rating of the building elements in Type IA construction shall be permitted to be reduced to the minimum fire-resistance ratings for the building elements in Type IB.

**Exception:** The required fire-resistance rating of the *Structural Frame* shall not be permitted to be reduced.

2. In other than Group F-1, M and S-1 occupancies, the fire-resistance rating of the building elements in Type IB construction shall be permitted to be reduced to the fire-resistance ratings in Type IIA.

**Exception:** *The required fire-resistance rating of the structural frame shall not be permitted to be reduced.*

3. The building height and building area limitations of a building containing building elements with reduced fire-resistance ratings shall be permitted to be the same as the building without such reductions.

**403.2.1.2 Shaft enclosures.** For buildings not greater than 420 feet (128 000 mm) in building height, the required fire-resistance rating of the fire barriers enclosing vertical shafts, other than exit enclosures and elevator hoistway enclosures, is permitted to be reduced to 1 hour where automatic sprinklers are installed within the shafts at the top and at alternate floor levels.

**403.2.2 Seismic considerations.** For seismic considerations, see Chapter 16.

**403.2.3 Structural integrity of interior exit stairways and elevator hoistway enclosures.** For high-rise buildings of Risk Category III or IV in accordance with Section 1604.5, and for all buildings that are more than 420 feet (128 000 mm) in building height, enclosures for interior exit stairways and elevator hoistway enclosures shall comply with Sections 403.2.3.1 through 403.2.3.4.

**403.2.3.1 Wall assembly.** The wall assemblies making up the enclosures for interior exit stairways and elevator hoistway enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C 1629/C 1629M.

**403.2.3.2 Wall assembly materials.** The face of the wall assemblies making up the enclosures for interior exit stairways and elevator hoistway enclosures that are not exposed to the interior of the enclosures for interior

exit stairways or elevator hoistway enclosure shall be constructed in accordance with one of the following methods:

1. The wall assembly shall incorporate no fewer than two layers of impact-resistant construction board each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C 1629/C 1629M.
2. The wall assembly shall incorporate no fewer than one layer of impact-resistant construction material that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C 1629/C 1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C 1629/C 1629M.

**403.2.3.3 Concrete and masonry walls.** Concrete or masonry walls shall be deemed to satisfy the requirements of Sections 403.2.3.1 and 403.2.3.2.

**403.2.3.4 Other wall assemblies.** Any other wall assembly that provides impact resistance equivalent to that required by Sections 403.2.3.1 and 403.2.3.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C 1629/C 1629M, shall be permitted.

**403.2.4 Sprayed fire-resistant materials (SFRM).** The bond strength of the SFRM installed throughout the building shall be in accordance with Table 403.2.4.

**TABLE 403.2.4  
MINIMUM BOND STRENGTH**

HEIGHT OF BUILDING <sup>a</sup>	SFRM MINIMUM BOND STRENGTH
Up to 420 feet	430 psf
Greater than 420 feet	1,000 psf

For SI: 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kW/m<sup>2</sup>.

a. Above the lowest level of fire department vehicle access.

**[F] 403.3 Automatic sprinkler system.** Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 903.3.5.2. *A sprinkler water-flow alarm-initiating device and a control valve with a supervisory signal-initiating device shall be provided at the lateral connection to the riser for each floor.*

**Exception:** An automatic sprinkler system shall not be required in open parking garages in accordance with Section 406.5.

**[F] 403.3.1 Number of sprinkler system risers and system design.** Each sprinkler system serving a floor in buildings that are more than 420 feet (128 000 mm) in building height shall be connected to a minimum of two sprinkler risers or combination standpipe system risers located in separate shafts. Each sprinkler system shall be hydraulically designed so that when one connection is shut

down, the other connection shall be capable of supplying the sprinkler system design demand.

**[F] 403.3.1.1 Riser location.** Sprinkler risers shall be placed in interior exit stairways and ramps that are remotely located in accordance with Section 1015.2.

**[F] 403.3.2 Water supply to required fire pumps.** Required fire pumps shall be supplied by connections to no fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

**Exceptions:**

1. Two connections to the same main shall be permitted provided the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through no fewer than one of the connections.
2. *High-rise buildings not having an occupied floor more than 120 feet above the lowest level of fire department vehicle access where a secondary water supply is provided in accordance with Section 903.3.5.2.*

**403.3.2.1 Fire pumps:** *Redundant fire pump systems shall be required for high-rise buildings having an occupied floor more than 200 feet above the lowest level of fire department vehicle access. Each fire pump system shall be capable of automatically supplying the required demand for the automatic sprinkler and standpipe systems.*

**[F] 403.3.3 Fire pump room.** Fire pumps shall be located in rooms protected in accordance with Section 913.2.1.

**403.3.4 Fire pumps.** See Section 913.6.

**[F] 403.4 Emergency systems.** The detection, alarm and emergency systems of high-rise buildings shall comply with Sections 403.4.1 through 403.4.9.

**[F] 403.4.1 Smoke detection.** Smoke detection shall be provided in accordance with Section 907.2.13.1.

**[F] 403.4.2 Fire alarm system.** A fire alarm system shall be provided in accordance with Section 907.2.13.

**[F] 403.4.3 Standpipe system.** A high-rise building shall be equipped with a standpipe system as required by Section 905.3.

**[F] 403.4.4 Emergency voice/alarm communication system.** An emergency voice/alarm communication system shall be provided in accordance with Section 907.5.2.2.

**[F] 403.4.5 Emergency responder radio coverage.** Emergency responder radio coverage shall be provided in accordance with Section 510 of the *California Fire Code*.

**[F] 403.4.6 Fire command.** A fire command center complying with Section 911 shall be provided in a location approved by the fire department.

**403.4.7 Smoke removal.**

**403.4.7.1 Smoke control system.** *High-rise buildings shall be provided with a passive or active smoke control system or combination thereof in accordance with Section 909*

**[F] 403.4.8 Standby power.** A standby power system complying with Chapter 27 and Section 3003 shall be provided for standby power loads specified in 403.4.8.2. Where elevators are provided in a high-rise building for accessible means of egress, fire service access or occupant self-evacuation, the standby power system shall also comply with Sections 1007.4, 3007 or 3008, as applicable.

**[F] 403.4.8.1 Special requirements for standby power systems.** If the standby system is a generator set inside a building, the system shall be located in a separate room enclosed with 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. System supervision with manual start and transfer features shall be provided at the fire command center.

**[F] 403.4.8.2 Standby power loads.** The following are classified as standby power loads:

1. Power and lighting for the fire command center required by Section 403.4.6;
2. Ventilation and automatic fire detection equipment for smokeproof enclosures; and
3. Elevators.

**[F] 403.4.9 Emergency power systems.** An emergency power system complying with Chapter 27 shall be provided for emergency power loads specified in Section 403.4.9.1.

**[F] 403.4.9.1 Emergency power loads.** The following are classified as emergency power loads:

1. Exit signs and means of egress illumination required by Chapter 10;
2. Elevator car lighting;
3. Emergency voice/alarm communications systems;
4. Automatic fire detection systems;
5. Fire alarm systems; and
6. Electrically powered fire pumps.

**403.5 Means of egress and evacuation.** The means of egress in high-rise buildings shall comply with Sections 403.5.1 through 403.5.6.

**403.5.1 Remoteness of interior exit stairways.** Required interior exit stairways shall be separated by a distance not less than 30 feet (9144 mm) or not less than one-fourth of the length of the maximum overall diagonal dimension of the building or area to be served, whichever is less. The distance shall be measured in a straight line between the nearest points of the interior exit stairways. In buildings with three or more interior exit stairways, no fewer than two of the interior exit stairways shall comply with this section. Interlocking or scissor stairs shall be counted as one interior exit stairway.

**403.5.2 Additional exit stairway.** For buildings other than Group R-2 that are more than 420 feet (128 000 mm) in building height, one additional exit stairway meeting the requirements of Sections 1009 and 1022 shall be provided in addition to the minimum number of exits required by Section 1021.1. The total width of any combination of remaining exit stairways with one exit stairway removed shall be not less than the total width required by Section 1005.1. Scissor stairs shall not be considered the additional exit stairway required by this section.

**Exception:** An additional exit stairway shall not be required to be installed in buildings having elevators used for occupant self-evacuation in accordance with Section 3008.

**403.5.3 Stairway door operation.** Stairway doors other than the exit discharge doors shall be permitted to be locked from the stairway side. Stairway doors that are locked from the stairway side shall be capable of being unlocked simultaneously without unlatching upon a signal from the fire command center. *Upon failure of electrical power to the locking mechanism the door shall unlock.*

**403.5.3.1 Stairway communication system.** A telephone or other two-way communications system connected to an approved constantly attended station shall be provided at not less than every fifth floor in each stairway where the doors to the stairway are locked.

**403.5.4 Smokeproof enclosures.** *Every exit enclosure in high-rise buildings shall comply with Sections 909.20 and 1022.9. Every required level exit stairway in Group I-2 occupancies serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall comply with Sections 909.20 and 1022.9.*

**Exception:** *In high-rise buildings, exit enclosures serving three or less adjacent floors where one of the adjacent floors is the level of exit discharge.*

**403.5.5 Luminous egress path markings.** Luminous egress path markings shall be provided in accordance with Section 1024.

**403.5.6 Emergency escape and rescue.** Emergency escape and rescue openings required by Section 1029 are not required.

**403.6 Elevators.** Elevator installation and operation in high-rise buildings shall comply with Chapter 30 and Sections 403.6.1 and 403.6.2.

*Enclosed elevator lobbies shall be provided in accordance with Section 713.14.1. Exceptions 3, 5, 6 and 8 shall only be permitted where approved by the Fire Chief in accordance with Section 1.11.2.1.1 or in accordance with Section 1.11.2.1.2 for all state-owned buildings, state-occupied buildings, and state institutions throughout the state.*

**403.6.1 Fire service access elevator.** In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, no fewer than two fire service access elevators, or all elevators, whichever is less, shall be provided in accordance with Section 3007. Each fire service access elevator shall have a capacity of not less than 3500 pounds (1588 kg).

**403.6.2 Occupant evacuation elevators.** Where installed in accordance with Section 3008, passenger elevators for general public use shall be permitted to be used for occupant self-evacuation.

**403.7 Existing high-rise buildings.** For existing high-rise buildings, see Section 3414.

## SECTION 404 ATRIUMS

**404.1 General.** In other than Group H occupancies, and where permitted by Section 712.1.6, the provisions of Sections 404.1 through 404.9 shall apply to buildings or structures containing vertical openings defined as "Atriums."

**404.1.1 Definition.** The following term is defined in Chapter 2:

### ATRIUM.

**404.2 Use.** The floor of the atrium shall not be used for other than low fire hazard uses and only approved materials and decorations in accordance with the *California Fire Code* shall be used in the atrium space.

**Exception:** The atrium floor area is permitted to be used for any approved use where the individual space is provided with an automatic sprinkler system in accordance with Section 903.3.1.1.

**[F] 404.3 Automatic sprinkler protection.** An approved automatic sprinkler system shall be installed throughout the entire building.

### Exceptions:

1. That area of a building adjacent to or above the atrium need not be sprinklered provided that portion of the building is separated from the atrium portion by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
2. Where the ceiling of the atrium is more than 55 feet (16 764 mm) above the floor, sprinkler protection at the ceiling of the atrium is not required.

**[F] 404.4 Fire alarm system.** A fire alarm system shall be provided in accordance with Section 907.2.14.

**404.5 Smoke control.** A smoke control system shall be installed in accordance with Section 909.

**Exception:** Smoke control is not required for atriums that connect only two stories.

**404.6 Enclosure of atriums.** Atrium spaces shall be separated from adjacent spaces by a 1-hour fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both.

**Exception:** A fire barrier is not required where a glass wall forming a smoke partition is provided. The glass wall shall comply with all of the following:

1. Automatic sprinklers are provided along both sides of the separation wall and doors, or on the room side

only if there is not a walkway on the atrium side. The sprinklers shall be located between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and at intervals along the glass not greater than 6 feet (1829 mm). The sprinkler system shall be designed so that the entire surface of the glass is wet upon activation of the sprinkler system without obstruction;

- 1.1. The glass wall shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates; and

- 1.2. Where glass doors are provided in the glass wall, they shall be either self-closing or automatic-closing.

2. A fire barrier is not required where a glass-block wall assembly complying with Section 2110 and having a  $\frac{3}{4}$ -hour fire protection rating is provided.

3. A fire barrier is not required between the atrium and the adjoining spaces of any three floors of the atrium provided such spaces are accounted for in the design of the smoke control system.

**[F] 404.7 Standby power.** Equipment required to provide smoke control shall be connected to a standby power system in accordance with Section 909.11.

**404.8 Interior finish.** The interior finish of walls and ceilings of the atrium shall be not less than Class B with no reduction in class for sprinkler protection.

**404.9 Travel distance.** In other than the lowest level of the atrium, where the required means of egress is through the atrium space, the portion of exit access travel distance within the atrium space shall be not greater than 200 feet (60 960 mm). The travel distance requirements for areas of buildings open to the atrium and where access to the exits is not through the atrium, shall comply with the requirements of Section 1016.

**404.10 Group I and R-2.1 occupancy means of egress.** Required means of egress from sleeping rooms in Group I and R-2.1 occupancies shall not pass through the atrium.

## SECTION 405 UNDERGROUND BUILDINGS

**405.1 General.** The provisions of Sections 405.2 through 405.10 apply to building spaces having a floor level used for human occupancy more than 30 feet (9144 mm) below the finished floor of the lowest level of exit discharge.

**Exception:** The provisions of Section 405 are not applicable to the following buildings or portions of buildings:

1. One- and two-family dwellings, sprinklered in accordance with Section 903.3.1.3.
2. Parking garages provided with automatic sprinkler systems in compliance with Section 405.3.
3. Fixed guideway transit systems.

4. Grandstands, bleachers, stadiums, arenas and similar facilities.
5. Where the lowest story is the only story that would qualify the building as an underground building and has an area not greater than 1,500 square feet (139 m<sup>2</sup>) and has an occupant load less than 10.
6. Pumping stations and other similar mechanical spaces intended only for limited periodic use by service or maintenance personnel.

**405.2 Construction requirements.** The underground portion of the building shall be of Type I construction.

**[F] 405.3 Automatic sprinkler system.** The highest level of exit discharge serving the underground portions of the building and all levels below shall be equipped with an automatic sprinkler system installed in accordance with Section 903.3.1.1. Water-flow switches and control valves shall be supervised in accordance with Section 903.4.

**405.4 Compartmentation.** Compartmentation shall be in accordance with Sections 405.4.1 through 405.4.3.

**405.4.1 Number of compartments.** A building having a floor level more than 60 feet (18 288 mm) below the finished floor of the lowest level of exit discharge shall be divided into no fewer than two compartments of approximately equal size. Such compartmentation shall extend through the highest level of exit discharge serving the underground portions of the building and all levels below.

**Exception:** The lowest story need not be compartmented where the area is not greater than 1,500 square feet (139 m<sup>2</sup>) and has an occupant load of less than 10.

**405.4.2 Smoke barrier penetration.** The compartments shall be separated from each other by a smoke barrier in accordance with Section 709. Penetrations between the two compartments shall be limited to plumbing and electrical piping and conduit that are firestopped in accordance with Section 714. Doorways shall be protected by fire door assemblies that are automatic-closing by smoke detection in accordance with Section 716.5.9.3 and are installed in accordance with NFPA 105 and Section 716.5.3. Where provided, each compartment shall have an air supply and an exhaust system independent of the other compartments.

**405.4.3 Elevators.** Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an elevator lobby shall be provided and shall be separated from each compartment by a smoke barrier in accordance with Section 709. Doors shall be gasketed, have a drop sill and be automatic-closing by smoke detection in accordance with Section 716.5.9.3.

**405.5 Smoke control system.** A smoke control system shall be provided in accordance with Sections 405.5.1 and 405.5.2.

**405.5.1 Control system.** A smoke control system is required to control the migration of products of combustion in accordance with Section 909 and the provisions of this section. Smoke control shall restrict movement of

smoke to the general area of fire origin and maintain means of egress in a usable condition.

**405.5.2 Compartment smoke control system.** Where compartmentation is required, each compartment shall have an independent smoke control system. The system shall be automatically activated and capable of manual operation in accordance with Sections 907.2.18 and 907.2.19.

**[F] 405.6 Fire alarm systems.** A fire alarm system shall be provided where required by Sections 907.2.18 and 907.2.19.

**405.7 Means of egress.** Means of egress shall be in accordance with Sections 405.7.1 and 405.7.2.

**405.7.1 Number of exits.** Each floor level shall be provided with no fewer than two exits. Where compartmentation is required by Section 405.4, each compartment shall have no fewer than one exit and shall also have no fewer than one exit access doorway into the adjoining compartment.

**405.7.2 Smokeproof enclosure.** Every required stairway serving floor levels more than 30 feet (9144 mm) below the finished floor of its level of exit discharge shall comply with the requirements for a smokeproof enclosure as provided in Section 1022.10.

**[F] 405.8 Standby power.** A standby power system complying with Chapter 27 shall be provided standby power loads specified in Section 405.8.1.

**[F] 405.8.1 Standby power loads.** The following loads are classified as standby power loads:

1. Smoke control system.
2. Ventilation and automatic fire detection equipment for smokeproof enclosures.
3. Fire pumps.

Standby power shall be provided for elevators in accordance with Section 3003.

**[F] 405.8.2 Pick-up time.** The standby power system shall pick up its connected loads within 60 seconds of failure of the normal power supply.

**[F] 405.9 Emergency power.** An emergency power system complying with Chapter 27 shall be provided for emergency power loads specified in Section 405.9.1.

**[F] 405.9.1 Emergency power loads.** The following loads are classified as emergency power loads:

1. Emergency voice/alarm communications systems.
2. Fire alarm systems.
3. Automatic fire detection systems.
4. Elevator car lighting.
5. Means of egress and exit sign illumination as required by Chapter 10.

**[F] 405.10 Standpipe system.** The underground building shall be equipped throughout with a standpipe system in accordance with Section 905.

## SECTION 406

### MOTOR-VEHICLE-RELATED OCCUPANCIES

*Section 406 has been completely reorganized from the 2009 code; therefore, the \* and \*\* margin indicators have not been included for clarity.*

**406.1 General.** Motor-vehicle-related occupancies shall comply with Sections 406.1 through 406.8.

**406.2 Definitions.** The following terms are defined in Chapter 2:

**MECHANICAL-ACCESS OPEN PARKING GARAGES.**  
**OPEN PARKING GARAGE.**

**RAMP-ACCESS OPEN PARKING GARAGES.**

**406.3 Private garages and carports.** Private garages and carports shall comply with Sections 406.3.1 through 406.3.5.

**406.3.1 Classification.** Buildings or parts of buildings classified as Group U occupancies because of the use or character of the occupancy shall be not greater than 1,000 square feet (93 m<sup>2</sup>) in area or one story in height except as provided in Section 406.3.2. Any building or portion thereof that exceeds the limitations specified in this section shall be classified in the occupancy group other than Group U that it most nearly resembles.

**406.3.2 Area increase.** Group U occupancies used for the storage of private or pleasure-type motor vehicles where no repair work is completed or fuel is dispensed are permitted to be 3,000 square feet (279 m<sup>2</sup>) where the following provisions are met:

1. For a mixed occupancy building, the exterior wall and opening protection for the Group U portion of the building shall be as required for the major occupancy of the building. For such a mixed occupancy building, the allowable floor area of the building shall be as permitted for the major occupancy contained therein.
2. For a building containing only a Group U occupancy, the exterior wall shall not be required to have a fire-resistance rating and the area of openings shall not be limited where the fire separation distance is 5 feet (1524 mm) or more.

More than one 3,000-square-foot (279 m<sup>2</sup>) Group U occupancy shall be permitted to be in the same structure, provided each 3,000-square-foot (279 m<sup>2</sup>) area is separated by fire walls complying with Section 706.

**406.3.3 Garages and carports.** Carports shall be open on no fewer than two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of this section for garages.

**Exception:** Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

**406.3.4 Separation.** Separations shall comply with the following:

1. The private garage shall be separated from the dwelling unit and its attic area by means of gypsum board, not less than 1/2 inch (12.7 mm) in thickness, applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than a 5/8-inch (15.9 mm) Type X gypsum board or equivalent and 1/2-inch (12.7 mm) gypsum board applied to structures supporting the separation from habitable rooms above the garage. Door openings between a private garage and the dwelling unit shall be equipped with either solid wood doors or solid or honeycomb core steel doors not less than 1 3/8 inches (34.9 mm) in thickness, or doors in compliance with Section 716.5.3 with a fire protection rating of not less than 20 minutes. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Doors shall be self-closing and self-latching.
2. Ducts in a private garage and ducts penetrating the walls or ceilings separating the dwelling unit, including its attic area, from the garage shall be constructed of sheet steel of not less than 0.019 inches (0.48 mm), in thickness, and shall have no openings into the garage.
3. A separation is not required between a Group R-3 and U carport, provided the carport is entirely open on two or more sides and there are not enclosed areas above.

**406.3.5 Automatic garage door openers.** Automatic garage door openers, if provided, shall be listed in accordance with UL 325. *See Health and Safety Code Sections 19890 and 19891 for additional provisions for residential garage door openers.*

**406.4 Public parking garages.** Parking garages other than private parking garages, shall be classified as public parking garages and shall comply with the provisions of Sections 406.4.2 through 406.4.8 and shall be classified as either an open parking garage or an enclosed parking garage. Open parking garages shall also comply with Section 406.5. Enclosed parking garages shall also comply with Section 406.6. *See Section 510 for special provisions for parking garages. (DSA-AC & HCD 1-AC) The clear height of vehicle and pedestrian areas required to be accessible shall comply with Chapter 11A or Chapter 11B, as applicable.*

**406.4.1 Clear height.** The clear height of each floor level in vehicle and pedestrian traffic areas shall be not less than 7 feet (2134 mm). *(DSA-AC & HCD 1-AC) The clear height of vehicle and pedestrian areas required to be accessible shall comply with Chapter 11A or Chapter 11B, as applicable.*

**406.4.2 Guards.** Guards shall be provided in accordance with Section 1013. Guards serving as vehicle barriers shall comply with Sections 406.4.3 and 1013.

**406.4.3 Vehicle barriers.** Vehicle barriers not less than 2 feet 9 inches (835 mm) in height shall be placed at the ends



of drive lanes, and at the end of parking spaces where the vertical distance to the ground or surface directly below is greater than 1 foot (305 mm). Vehicle barriers shall comply with the loading requirements of Section 1607.8.3.

**Exception:** Vehicle barriers are not required in vehicle storage compartments in a mechanical access parking garage.

**406.4.4 Ramps.** Vehicle ramps shall not be considered as required exits unless pedestrian facilities are provided. Vehicle ramps that are utilized for vertical circulation as well as for parking shall not exceed a slope of 1:15 (6.67 percent).

**406.4.5 Floor surface.** Parking surfaces shall be of concrete or similar noncombustible and nonabsorbent materials.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

**Exceptions:**

1. Asphalt parking surfaces shall be permitted at ground level.
2. Floors of Group S-2 parking garages shall not be required to have a sloped surface.

**406.4.6 Mixed occupancy separation.** Parking garages shall be separated from other occupancies in accordance with Section 508.1.

**406.4.7 Special hazards.** Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation.

**Exception:** A single door shall be allowed provided the sources of ignition in the appliance are not less than 18 inches (457 mm) above the floor.

**406.4.8 Attached to rooms.** Openings from a parking garage directly into a room used for sleeping purposes shall not be permitted.

**406.5 Open parking garages.** Open parking garages shall comply with Sections 406.5.1 through 406.5.11.

**406.5.1 Construction.** Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of Chapter 16. For vehicle barriers, see Section 406.4.3.

**406.5.2 Openings.** For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier shall be not less than 20 percent of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall be not less than 40 percent of the perimeter of the tier. Interior walls shall be not less than 20 percent open with uniformly distributed openings.

**Exception:** Openings are not required to be distributed over 40 percent of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

**406.5.2.1 Openings below grade.** Where openings below grade provide required natural ventilation, the outside horizontal clear space shall be one and one-half times the depth of the opening. The width of the horizontal clear space shall be maintained from grade down to the bottom of the lowest required opening.

**406.5.3 Uses.** Mixed uses shall be allowed in the same building as an open parking garage subject to the provisions of Sections 402.4.2.3, 406.5.11, 508.1, 510.3, 510.4 and 510.7.

**406.5.4 Area and height.** Area and height of open parking garages shall be limited as set forth in Chapter 5 for Group S-2 occupancies and as further provided for in Section 508.1.

**406.5.4.1 Single use.** Where the open parking garage is used exclusively for the parking or storage of private motor vehicles, with no other uses in the building, the area and height shall be permitted to comply with Table 406.5.4, along with increases allowed by Section 406.5.5.

**Exception:** The grade-level tier is permitted to contain an office, waiting and toilet rooms having a total combined area of not more than 1,000 square feet (93 m<sup>2</sup>). Such area need not be separated from the open parking garage.

In open parking garages having a spiral or sloping floor, the horizontal projection of the structure at any cross section shall not exceed the allowable area per parking tier. In the case of an open parking garage having a continuous spiral floor, each 9 feet 6 inches (2896 mm) of height, or portion thereof, shall be considered a tier.

**TABLE 406.5.4  
OPEN PARKING GARAGES AREA AND HEIGHT**

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

The clear height of a parking tier shall be not less than 7 feet (2134 mm), except that a lower clear height is permitted in mechanical-access open parking garages where approved by the building official.

**406.5.5 Area and height increases.** The allowable area and height of open parking garages shall be increased in accordance with the provisions of this section. Garages with sides open on three-fourths of the building's perimeter are permitted to be increased by 25 percent in area and one tier in height. Garages with sides open around the entire building's perimeter are permitted to be increased by 50 percent in area and one tier in height. For a side to be considered open under the above provisions, the total area of openings along the side shall not be less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. For purposes of calculating the interior area of the side, the height shall not exceed 7 feet (2134 mm).

Allowable tier areas in Table 406.5.4 shall be increased for open parking garages constructed to heights less than the table maximum. The gross tier area of the garage shall not exceed that permitted for the higher structure. No fewer than three sides of each such larger tier shall have continuous horizontal openings not less than 30 inches (762 mm) in clear height extending for not less than 80 percent of the length of the sides and no part of such larger tier shall be more than 200 feet (60 960 mm) horizontally from such an opening. In addition, each such opening shall face a street or yard accessible to a street with a width of not less than 30 feet (9144 mm) for the full length of the opening, and standpipes shall be provided in each such tier.

Open parking garages of Type II construction, with all sides open, shall be unlimited in allowable area where the building height does not exceed 75 feet (22 860 mm). For a side to be considered open, the total area of openings along the side shall not be less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. For purposes of calculating the interior area of the side, the height shall not exceed 7 feet (2134 mm). All portions of tiers shall be within 200 feet (60 960 mm) horizontally from such openings or other natural ventilation openings as defined in Section 406.5.2. These openings shall be permitted to be provided in courts with a minimum dimension of 20 feet (6096 mm) for the full width of the openings.

**406.5.6 Fire separation distance.** Exterior walls and openings in exterior walls shall comply with Tables 601 and 602. The distance to an adjacent lot line shall be determined in accordance with Table 602 and Section 705.

**406.5.7 Means of egress.** Where persons other than parking attendants are permitted, open parking garages shall meet the means of egress requirements of Chapter 10. Where no persons other than parking attendants are permitted, there shall be no fewer than two exit stairways. Each exit stairway shall be not less than 36 inches (914 mm) in width. Lifts shall be permitted to be installed for use of employees only, provided they are completely enclosed by noncombustible materials.

**[F] 406.5.8 Standpipe system.** An open parking garage shall be equipped with a standpipe system as required by Section 905.3.

**406.5.9 Enclosure of vertical openings.** Enclosure shall not be required for vertical openings except as specified in Section 406.5.7.

**406.5.10 Ventilation.** Ventilation, other than the percentage of openings specified in Section 406.5.2, shall not be required.

**406.5.11 Prohibitions.** The following uses and alterations are not permitted:

1. Vehicle repair work.
2. Parking of buses, trucks and similar vehicles.
3. Partial or complete closing of required openings in exterior walls by tarpaulins or any other means.
4. Dispensing of fuel.

**406.6 Enclosed parking garages.** Enclosed parking garages shall comply with Sections 406.6.1 through 406.6.3.

**406.6.1 Heights and areas.** Enclosed vehicle parking garages and portions thereof that do not meet the definition of open parking garages shall be limited to the allowable heights and areas specified in Table 503 as modified by Sections 504, 506 and 507. Roof parking is permitted.

**406.6.2 Ventilation.** A mechanical ventilation system shall be provided in accordance with the *California Mechanical Code*.

**[F] 406.6.3 Automatic sprinkler system.** An enclosed parking garage shall be equipped with an automatic sprinkler system in accordance with Section 903.2.10.

**406.7 Motor fuel-dispensing facilities.** Motor fuel-dispensing facilities shall comply with the *California Fire Code* and Sections 406.7.1 and 406.7.2.

**406.7.1 Vehicle fueling pad.** The vehicle shall be fueled on noncoated concrete or other approved paving material having a resistance not exceeding 1 megohm as determined by the methodology in EN 1081.

**406.7.2 Canopies.** Canopies under which fuels are dispensed shall have a clear, unobstructed height of not less than 13 feet 6 inches (4115 mm) to the lowest projecting element in the vehicle drive-through area. Canopies and their supports over pumps shall be of noncombustible materials, fire-retardant-treated wood complying with Chapter 23, wood of Type IV sizes or of construction providing 1-hour fire resistance. Combustible materials used in or on a canopy shall comply with one of the following:

1. Shielded from the pumps by a noncombustible element of the canopy, or wood of Type IV sizes;
2. Plastics covered by aluminum facing having a thickness of not less than 0.010 inch (0.30 mm) or corrosion-resistant steel having a base metal thickness of not less than 0.016 inch (0.41 mm). The plastic shall have a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in the form intended for use in accordance with ASTM E

84 or UL 723 and a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929; or

3. Panels constructed of light-transmitting plastic materials shall be permitted to be installed in canopies erected over motor vehicle fuel-dispensing station fuel dispensers, provided the panels are located not less than 10 feet (3048 mm) from any building on the same lot and face yards or streets not less than 40 feet (12 192 mm) in width on the other sides. The aggregate areas of plastics shall be not greater than 1,000 square feet (93 m<sup>2</sup>). The maximum area of any individual panel shall be not greater than 100 square feet (9.3 m<sup>2</sup>).

**406.7.2.1 Canopies used to support gaseous hydrogen systems.** Canopies that are used to shelter dispensing operations where flammable compressed gases are located on the roof of the canopy shall be in accordance with the following:

1. The canopy shall meet or exceed Type I construction requirements.
2. Operations located under canopies shall be limited to refueling only.
3. The canopy shall be constructed in a manner that prevents the accumulation of hydrogen gas.

**406.8 Repair garages.** Repair garages shall be constructed in accordance with the *California Fire Code* and Sections 406.8.1 through 406.8.6. This occupancy shall not include motor fuel-dispensing facilities, as regulated in Section 406.7.

**406.8.1 Mixed uses.** Mixed uses shall be allowed in the same building as a repair garage subject to the provisions of Section 508.1.

**406.8.2 Ventilation.** Repair garages shall be mechanically ventilated in accordance with the *California Mechanical Code*. The ventilation system shall be controlled at the entrance to the garage.

**406.8.3 Floor surface.** Repair garage floors shall be of concrete or similar noncombustible and nonabsorbent materials.

**Exception:** Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 0.45 W/cm<sup>2</sup>, as determined by NFPA 253, shall be permitted.

**406.8.4 Heating equipment.** Heating equipment shall be installed in accordance with the *California Mechanical Code*.

**[F] 406.8.5 Gas detection system.** Repair garages used for the repair of vehicles fueled by nonodorized gases such as hydrogen and nonodorized LNG, shall be provided with a flammable gas detection system.

**[F] 406.8.5.1 System design.** The flammable gas detection system shall be listed or approved and shall be calibrated to the types of fuels or gases used by vehicles to be repaired. The gas detection system shall be designed to activate when the level of flammable gas

exceeds 25 percent of the lower flammable limit (LFL). Gas detection shall be provided in lubrication or chassis service pits of repair garages used for repairing nonodorized LNG-fueled vehicles.

**[F] 406.8.5.1.1 Gas detection system components.**

Gas detection system control units shall be listed and labeled in accordance with UL 864 or UL 2017. Gas detectors shall be listed and labeled in accordance with UL 2075 for use with the gases and vapors being detected.

**[F] 406.8.5.2 Operation.** Activation of the gas detection system shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals in the repair garage.
2. Deactivation of all heating systems located in the repair garage.
3. Activation of the mechanical ventilation system, where the system is interlocked with gas detection.

**[F] 406.8.5.3 Failure of the gas detection system.**

Failure of the gas detection system shall result in the deactivation of the heating system, activation of the mechanical ventilation system where the system is interlocked with the gas detection system and cause a trouble signal to sound in an approved location.

**[F] 406.8.6 Automatic sprinkler system.** A repair garage shall be equipped with an automatic sprinkler system in accordance with Section 903.2.9.1.

**406.9 Electric vehicle. [SFM]**

**406.9.1 Electric vehicle.** An automotive-type vehicle for highway use, such as passenger automobiles, buses, trucks, vans and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array or other source of electric current. For the purpose of this chapter, electric motorcycles and similar type vehicles and off-road self-propelled electric vehicles such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not included.

**406.9.2 Charging.** In any building or interior area used for charging electric vehicles, electrical equipment shall be installed in accordance with the *California Electrical Code*.

**406.9.3 Ventilation.** Mechanical exhaust ventilation, when required by the *California Electrical Code* shall be provided at a rate as required by Article 625 or as required by Section 1203 of the *California Building Code* whichever is greater. The ventilation system shall include both the supply and exhaust equipment and shall be permanently installed and located to intake supply air from the outdoors, and vent the exhaust directly to, the outdoors without conducting the exhaust air through other spaces within the building.

**Exception:** Positive pressure ventilation systems shall only be allowed in buildings or areas that have been designed and approved for that application.

**406.9.4 Electrical interface.** *The electrical supply circuit to electrically powered mechanical ventilation equipment shall be interlocked with the recharging equipment used to supply the vehicle(s) being charged, and shall remain energized during the entire charging cycle. Electric vehicle recharging equipment shall be marked or labeled in accordance with the California Electrical Code.*

**Exceptions:**

1. Exhaust ventilation shall not be required in areas with an approved engineered ventilation system, which maintains a hydrogen gas concentration at less than 25 percent of the lower flammability limit.
2. Mechanical exhaust ventilation for hydrogen shall not be required where the charging equipment utilized is installed and listed for indoor charging of electric vehicles without ventilation.

**SECTION 407  
GROUP I-2**

**407.1 General.** Occupancies in Group I-2 and I-2.1 shall comply with the provisions of Sections 407.1 through 407.10 and other applicable provisions of this code.

**407.2 Corridors continuity and separation.** Corridors in occupancies in Group I-2 shall be continuous to the exits and shall be separated from other areas in accordance with Section 407.3 except spaces conforming to Sections 407.2.1 through 407.2.4.

**407.2.1 Waiting and similar areas.** Waiting areas and similar spaces constructed as required for corridors shall be permitted to be open to a corridor, only where all of the following criteria are met:

1. The spaces are not occupied as care recipient's sleeping rooms, treatment rooms, incidental uses listed in Table 509, or hazardous uses.
2. The open space is protected by an automatic fire detection system installed in accordance with Section 907.
3. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic fire detection system installed in accordance with Section 907, or the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
4. The space is arranged so as not to obstruct access to the required exits.
5. Each space is located to permit direct visual supervision by the facility staff.

**407.2.2 Nurses' stations.** Spaces for doctors' and nurses' charting, communications and related clerical areas shall be permitted to be open to, or located within the corridor, provided the required construction along the perimeter of the corridor is maintained. Construction of nurses' stations or portions of nurses' stations, within the envelope of the corridor is not required to be fire-resistive rated.

*Nurses' stations in new and existing facilities see the California Code of Regulations, Title 19, Division 1, Chapter 1, Subchapter 1, Article 3, Section 3.11(d) for storage and equipment requirements.*

*In detention or secure mental health facilities, the provisions above applies to enclosed nurses' stations within the corridor.*

**407.2.3 Psychiatric treatment areas.** Areas wherein psychiatric care recipients who are not capable of self-preservation are housed, or group meeting or multipurpose therapeutic spaces other than incidental uses in accordance with Section 509, under continuous supervision by facility staff, shall be permitted to be open to the corridor, where the following criteria are met:

1. Each area does not exceed 1,500 square feet (140 m<sup>2</sup>).
2. The area is located to permit supervision by the facility staff.
3. The area is arranged so as not to obstruct any access to the required exits.
4. The area is equipped with an automatic fire detection system installed in accordance with Section 907.2.
5. Not more than one such space is permitted in any one smoke compartment.
6. The walls and ceilings of the space are constructed as required for corridors.

**407.2.4 Gift shops.** Gift shops and associated storage that are less than 500 square feet (455 m<sup>2</sup>) in area shall be permitted to be open to the corridor where such spaces are constructed as required for corridors.

**407.3 Corridor wall construction.** Corridor walls shall be constructed as fire partitions in accordance with Section 708.

**407.3.1 Corridor doors.** Corridor doors, other than those in a wall required to be rated by Section 509.4 or for the enclosure of a vertical opening or an exit, shall not have a required fire protection rating and shall not be required to be equipped with self-closing or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching. Roller latches are not permitted. Other doors shall conform to Section 716.5. *In Group I-2 Occupancies, self-closing or automatic-closing devices are not required on corridor doors to patient sleeping rooms, treatment rooms, and offices located in areas specified in Sections 1224 and 1225, excluding offices specified in Sections 1224.21 and 1225.8.*

**407.3.1.1 Swing of corridor doors.** Corridor doors, other than those equipped with self-closing or automatic-closing devices shall not swing into the required width of corridors.

**Exception:** *Doors may swing into required width of corridors in I-3 facilities as long as 44" clear is maintained with any one door open 90 degrees and clear corridor widths required in Chapter 12 can be maintained with doors open 180 degrees.*

**407.3.2 Glazing.** *In fully sprinklered buildings, fixed fully tempered or laminated glass in wood or metal frames may be used in corridor walls, provided the glazed area does not exceed 25 percent of the areas of the corridor wall of the room. The total area of glass in corridor walls is not limited when the glazing is fixed 1/4-inch-thick (6.4 mm) wired glass in steel frames and the size of individual glazed panel does not exceed 1,296 square inches (0.836 m<sup>2</sup>).*

**\*\* 407.4 Means of egress.** Group I-2 occupancies shall be provided with means of egress complying with Chapter 10 and Sections 407.4.1 through 407.4.3.

**407.4.1 Direct access to a corridor.** Habitable rooms in Group I-2 occupancies shall have an exit access door leading directly to a corridor.

**Exceptions:**

1. Rooms with exit doors opening directly to the outside at ground level.
2. Rooms arranged as care suites complying with Section 407.4.3

**407.4.1.1 Locking devices.** Locking devices that restrict access to a care recipient's room from the corridor and that are operable only by staff from the corridor side shall not restrict the means of egress from the care recipient's room.

**Exceptions:**

1. This section shall not apply to rooms in psychiatric treatment and similar care areas.
2. Locking arrangements in accordance with Section 1008.1.9.6.

**407.4.1.2 Basement exits.** *All rooms below grade shall have not less than one exit access that leads directly to an exterior exit door opening directly to an exit discharge at grade plane or the public way.*

**407.4.2 Travel distance.** The travel distance between any point in a Group I-2 occupancy sleeping room and an exit access door in that room shall be not greater than 50 feet (15 240 mm).

**407.4.3 Group I-2 care suites.** Care suites in Group I-2 shall comply with Sections 407.4.3.1 through 407.4.3.4 and either Section 407.4.3.5 or 407.4.3.6.

**407.4.3.1 Exit access through care suites.** Exit access from all other portions of a building not classified as a care suite shall not pass through a care suite. In a care suite required to have more than one exit, one exit access is permitted to pass through an adjacent care suite provided all of the other requirements of Sections 407.4 and 1014.2 are satisfied.

**407.4.3.2 Separation.** Care suites shall be separated from other portions of the building by *not less than a one-hour fire barrier* complying with Section 707. *Each suite of rooms shall be separated from the remainder of the building by not less than a one-hour fire barrier.*

**407.4.3.3 One intervening room.** For rooms other than sleeping rooms located within a care suite, exit access travel from the care suite shall be permitted through one intervening room where the travel distance to the exit access door from the care suite is not greater than 100 feet (30 480 mm).

**407.4.3.4 Two intervening rooms.** For rooms other than sleeping rooms located within a care suite, exit access travel within the care suite shall be permitted through two intervening rooms where the travel distance to the exit access door from the care suite is not greater than 50 feet (15 240 mm).

**407.4.3.5 Care suites containing sleeping room areas.** Sleeping rooms shall be permitted to be grouped into care suites with one intervening room if one of the following conditions is met:

1. The intervening room within the care suite is not used as an exit access for more than eight care recipient beds.
2. The arrangement of the care suite allows for direct and constant visual supervision by care providers.

**407.4.3.5.1 Area.** Care suites containing sleeping rooms shall be not greater than 5,000 square feet (465 m<sup>2</sup>) in area.

**407.4.3.5.2 Exit access.** Any sleeping room, or any care suite that contains sleeping rooms, of more than 1,000 square feet (93 m<sup>2</sup>) shall have no fewer than two exit access doors from the care suite located in accordance with Section 1015.2.

**407.4.3.5.3 Travel distance.** The travel distance between any point in a care suite containing sleeping rooms and an exit access door from that care suite shall be not greater than 100 feet (30 480 mm).

**407.4.3.6 Care suites not containing sleeping rooms.** Areas not containing sleeping rooms, but only treatment areas and the associated rooms, spaces or circulation space shall be permitted to be grouped into care suites and shall conform to the limitations in Section 407.4.3.6.1 and 407.4.3.6.2.

**407.4.3.6.1 Area.** Care suites of rooms, other than sleeping rooms, shall have an area not greater than 10,000 square feet (929 m<sup>2</sup>).

**407.4.3.6.2 Exit access.** Care suites, other than sleeping rooms, with an area of more than 2,500 square feet (232 m<sup>2</sup>) shall have no fewer than two exit access doors from the care suite located in accordance with Section 1015.2.

**407.5 Smoke barriers.** Smoke barriers shall be provided to subdivide every story used by persons receiving care, treatment or sleeping and to divide other stories with an occupant load of 50 or more persons, into no fewer than two smoke compartments. Such stories shall be divided into smoke compartments with an area of not more than 22,500 square feet (2092 m<sup>2</sup>) and the travel distance from any point in a smoke compartment to a smoke barrier door shall be not greater than

200 feet (60 960 mm). The smoke barrier shall be in accordance with Section 709.

**Exceptions:**

1. This requirement shall not apply to Group I-2.1 less than 10,000 ft<sup>2</sup> (929 m<sup>2</sup>).
2. An area in an adjoining occupancy shall be permitted to serve as a smoke compartment for a Group I-2.1 facility if the following criteria are met:
  - 2.1. The separating wall and both compartments meet the requirements of 407.5.
  - 2.2. The Group I-2.1 is less than 22,500 ft<sup>2</sup> (2100 m<sup>2</sup>).
  - 2.3. Access from the Group I-2.1 to the other occupancy is unrestricted.

**407.5.1 Refuge area.** Refuge areas shall be provided within each smoke compartment. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining smoke compartment. Where a smoke compartment is adjoined by two or more smoke compartments, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments. The size of the refuge area shall provide the following:

1. Not less than 30 net square feet (2.8 m<sup>2</sup>) for each care recipient confined to bed or litter.
2. Not less than 6 square feet (0.56 m<sup>2</sup>) for each ambulatory care recipient not confined to bed or litter and for other occupants.

Areas or spaces permitted to be included in the calculation of refuge area are corridors, sleeping areas, treatment rooms, lounge or dining areas and other low-hazard areas.

**407.5.2 Independent egress.** At least two means of egress shall be provided from each smoke compartment created by smoke barriers. Means of egress may pass through adjacent compartments provided it does not return through the smoke compartment from which means of egress originated.

**407.5.3 Horizontal assemblies.** Horizontal assemblies supporting smoke barriers required by this section shall be designed to resist the movement of smoke and shall comply with Section 711.9.

**[F] 407.6 Automatic sprinkler system.** Every facility as specified herein wherein more than six clients or patients are housed or cared for on the premises on a 24-hour per-day-basis shall have installed and maintained in an operable condition in every building or portion thereof where clients or patients are housed, an automatic sprinkler system of a type approved by the state fire marshal. The provisions of this subsection shall apply to every person, firm or corporation establishing, maintaining or operating a hospital, children's home, children's nursery or institution, or a home or institution for the care of aged or persons with dementia or other

cognitive impairments, or any institution for persons with mental illness or persons with developmental disabilities and any nursing or convalescent home, and to any state-owned or state-occupied building used for any of the types of facilities specified herein.

**Exceptions:**

1. This section shall not apply to homes or institutions for the 24-hour-per-day care of ambulatory children if all of the following conditions are satisfied:
  - 1.1. The buildings or portions thereof in which children are housed are not more than two stories in height and are constructed and maintained in accordance with regulations adopted by the state fire marshal.
  - 1.2. The buildings or portions thereof housing more than six such children shall have installed and maintained in an operable condition therein, a fire alarm system of a type approved by the state fire marshal. Such system shall be activated by detectors responding to invisible particles of combustion other than heat, except that detectors used in closets, usable under-floor areas, storage rooms, bathrooms, attached garages, attics, plenums, laundry rooms and rooms of similar use, may be heat-responsive devices.
  - 1.3. The building or portions thereof do not house persons with mental illness or children with developmental disabilities.
2. This section shall not apply to any one-story building or structure of an institution or home for the care of the aged providing 24-hour-per-day care if such building or structure is used or intended to be used for the housing of no more than six ambulatory aged persons. Such buildings or institutions shall have installed and maintained in an operable condition herein a fire alarm system of a type approved by the state fire marshal. Such system shall be activated by detectors responding to either visible or invisible particles of combustion other than heat, except that detectors used in closets, usable under-floor areas, storage rooms, bathrooms, attached garages, attics, plenums, laundry rooms and rooms of similar use, may be heat-responsive devices.
3. This section shall not apply to occupancies or any alterations thereto conforming to the construction provisions of this exception which were under construction or in existence on March 4, 1972. "Under construction" as used in this exception shall mean that actual work had been performed on the construction site and shall not be construed to mean that the hospital, home, nursery, institution, sanitarium or any portion thereof, was or is in the planning stage. The provisions of this exception shall apply to those buildings or structures having bearing walls

*and structural flame protected in accordance with the provisions of Column Type 1A of Table 601.*

4. *In detention facilities where inmates are not restrained.*

*The provisions of this section shall not apply to any facility used to house six or less persons on the premises.*

**407.6.1** *When a new addition is to be made to an unsprinklered building or structure as permitted by this subsection, such new addition shall be sprinklered as required by this section and shall be separated from the existing building or structures by not less than a two-hour fire-resistive fire barrier.*

*When a sprinkler system is added to an existing unsprinklered building or structure, the sprinklered area(s) shall be separated from the remainder of the building by not less than a one-hour fire-resistive fire barrier. The provisions of this section do not apply to any facility used to house six or less persons on the premises.*

**[F] 407.7 Fire alarm system.** A fire alarm system shall be provided in accordance with Section 907.2.6.

**[F] 407.8 Automatic fire detection.** *See Section 907.2.6.2.*

**407.9 Secured yards.** Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet (2.8 m<sup>2</sup>) for bed and litter care recipients and 6 net square feet (0.56 m<sup>2</sup>) for ambulatory care recipients and other occupants are located between the building and the fence. Such provided safe dispersal area shall be located not less than 50 feet (15 240 mm) from the building they serve. *Each safe dispersal area shall have a minimum of two exits. The aggregate clear width of exits from a safe dispersal area shall be determined on the basis of not less than one exit unit of 22 inches (559 mm) for each 500 persons to be accommodated, and no exit shall be less than 44 inches (1118 mm) in width. Gates shall not be installed across corridors or passageways leading to such dispersal areas unless they comply with egress requirements. Keys to gate locks shall be provided in accordance with the California Fire Code.*

**407.10 Hyperbaric facilities.** Hyperbaric facilities in Group I-2 occupancies shall meet the requirements contained in Chapter 20 of NFPA 99.

#### **407.11 Special Hazards.**

**407.11.1** *Storage and handling of flammable, combustible liquids and hazardous materials shall be in accordance with the California Fire Code.*

**407.11.2** *All exterior openings in a boiler room or room containing central heating equipment, if located below openings in another story, or if less than 10 feet (3048 mm) from other doors or windows of the same building, shall be protected by a fire assembly having a three-fourths-hour fire protection rating.*

**407.11.3 Safety padding.** *See Sections 308.1 and 408.14.*

**407.11.4 Floor Surfaces.** *Rooms occupied by patients whose personal liberties are restrained shall have non-combustible floor surfaces see Sections 308.1 and 804.4.2.*

## **SECTION 408 GROUP I-3**

**408.1 General.** Occupancies in Group I-3 shall comply with the provisions of Sections 408.1 through 408.11 and other applicable provisions of this code (see Section 308.5).

**408.1.1 Definitions.** The following terms are defined in Chapter 2:

**CELL.**

**CELL COMPLEX.**

**CELL TIERS.**

**CENTRAL CONTROL BUILDING.**

**DAY ROOM.**

**DORMITORY.**

**HOLDING FACILITY.**

**HOUSING UNIT.**

**RESTRAINT.**

**SALLYPORT.**

**SMALL MANAGEMENT YARD.**

**408.1.2 Construction.** Group I-3 Occupancies shall be housed in buildings of Type IA or Type IB.

**Exception:** Such occupancies may be housed in one-story buildings of Type IIA, Type IIIA or Type VA construction provided the floor area does not exceed 5,200 square feet (483m<sup>2</sup>) between fire walls of two-hour fire-resistive construction with openings protected by fire assemblies having 1- and 1½-hour fire-protection rating.

**408.1.2.1 Nonbearing walls and partitions interior.** Nonbearing cell or dormitory walls within cell complexes shall be of noncombustible construction.

**408.1.2.2 Intervening spaces.** *Common rooms and spaces within Group I-3 occupancies can be considered an intervening space in accordance with Section 1014.2, and not considered a corridor, when they meet any of the following:*

1. *The inmate and/or staff movement within cell complexes, medical housing wings and mental health housing wings of Type I construction.*
2. *Areas within any temporary holding area of non-combustible construction.*
3. *Areas within secure mental health treatment facilities of noncombustible construction.*

**408.1.2.3 Courthouse holding facilities.** *Group I-3 courthouse holding facilities shall be considered a separate and distinct building from the remaining courthouse building for the purpose of determining the type of construction where all of the following conditions are met:*

1. *2-hour fire barriers in accordance with Section 707 and 2-hour horizontal assemblies in accordance with Section 711 are provided to separate*

the courthouse holding facility from all other portions of the courthouse building.

2. Any of the structure used to support courthouse holding facilities meets the requirements for the Group I-3 portion of the building.
3. Each courthouse holding facility located above the first story is less than 1,000 square feet in area, and is designed to hold 10 or less in-custody defendants.
4. Courthouse holding facilities located above the first story containing an internal stairway discharging to the main courthouse holding facility at the first story or basement.
5. Additional exits from the courthouse holding facility located above the first story shall be permitted to exit through the courtrooms.
6. The main courthouse holding facility located on the first story or basement has at least one exit directly to the exterior and additional means of egress shall be permitted to pass through a 1-hour corridor or lobby in the courthouse building.

**408.1.2.4 Horizontal building separation for combined Group I-3/Group B occupancy.** A Group B Administration building one story in height shall be permitted to be located above a Group I-3 (or Group I-3/I-2) housing/treatment building that is one story above grade and shall be classified as a separate and distinct building for the purpose of determining the type of construction, and shall be considered a separate fire area, where all of the following conditions are met:

1. A 3-hour floor-ceiling assembly below the administration building is constructed as a horizontal assembly in accordance with Section 711.
2. Interior shafts for stairs, elevators and mechanical systems complete the 3-hour separation between the Group B and Group I-3 (or Group I-3/I-2).
3. The Group I-3 occupancy (or Group I-3/I-2 occupancies, correctional medical and mental health uses) below is minimum Type I-B construction with 2-hour fire resistive rated exterior walls.
4. No unprotected openings are allowed in lower roofs within 10 feet of unprotected windows in the upper floor.
5. The Group B building above is of noncombustible construction and equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
6. The Group B occupancy building above has all required means of egress capable of discharging directly to the exterior to a safe dispersal area.

**408.1.2.5 Temporary holding area.** In buildings protected with automatic sprinklers, corridor serving temporary holding rooms shall be one hour fire resistance

rated when the temporary holding occupant load is greater than 20.

**408.1.2.6 Temporary holding facilities.** Temporary holding facilities with nine or fewer persons under restraint may be classified as Group B when located in a buildings complying with all of the following conditions:

1. The building shall be protected throughout with a monitored automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. The building shall protected with a automatic fire alarm system with notification appliances throughout the holding facility in accordance with Section 907.2.
3. The building shall be constructed of Type I, IIA, IIIA or VA construction.

**408.1.2.7 Secure interview rooms.** Secure Interview Rooms used for law enforcement shall be permitted to locked, and shall not be classified as Group I-3 occupancies where all of the following conditions are met:

1. A monitored automatic sprinkler system shall be provided throughout buildings and portions thereof including secure interview rooms. The automatic sprinkler system shall comply with Section 903.1.1.
2. Secure interview rooms shall be located in non-combustible construction.
3. Secure interview rooms have glazed or barred openings with direct, continuous observation from law enforcement personnel who have a means to open the secure interview room.
4. Not more than 6 occupants in secure interview rooms shall be located in the same fire area.
5. An automatic smoke detection system shall be installed within secure interview rooms and mechanical and electrical rooms.

**408.2 Other occupancies.** Buildings or portions of buildings in Group I-3 occupancies where security operations necessitate the locking of required means of egress shall be permitted to be classified as a different occupancy. Occupancies classified as other than Group I-3 shall meet the applicable requirements of this code for that occupancy provided provisions are made for the release of occupants at all times.

Means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, conform to requirements for detention and correctional occupancies.

**Exception:**

1. It is permissible to exit through a horizontal exit into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions but that do comply with requirements set forth in the appropriate occupancy, as long as the occupancy is not a Group H use.



2. Regardless of the provisions of Section 508, laundry areas and kitchens including associated dining areas, where commercial/institutional equipment is used shall be separated from the remainder of the building by construction capable of resisting the passage of smoke.

3. For the purpose of occupancy separation only courtroom docks that are directly accessory to courtrooms need not be separated from a courtroom.

**408.2.1 Correctional medical and mental health uses.** Where a Group I-2 occupancy in accordance with Section 308.4 and a Group I-3 occupancy occur together in building or portions of buildings, the following Subsections of Sections of 407 shall apply: 407.2.1; 407.2.2; 407.2.3; 407.3.1; 407.3.1.1; 407.4; 407.10.2.

**408.3 Means of egress.** Except as modified or as provided for in this section, the means of egress provisions of Chapter 10 shall apply.

**408.3.1 Door width.** Doors to resident sleeping units shall have a clear width of not less than 28 inches (711 mm).

**408.3.1.1 Cell doors shall open outwardly or slide laterally.**

**408.3.2 Sliding doors.** Where doors in a means of egress are of the horizontal-sliding type, the force to slide the door to its fully open position shall be not greater than 50 pounds (220 N) with a perpendicular force against the door of 50 pounds (220 N).

**408.3.3 Guard tower doors.** A hatch or trap door not less than 16 square feet (610 m<sup>2</sup>) in area through the floor and having dimensions of not less than 2 feet (610 mm) in any direction shall be permitted to be used as a portion of the means of egress from guard towers.

**408.3.4 Spiral stairways.** Spiral stairways that conform to the requirements of Section 1009.12 are permitted for access to and between staff locations.

**408.3.5 Ship ladders.** Ship ladders shall be permitted for egress from control rooms or elevated facility observation rooms in accordance with Section 1009.14.

**408.3.6 Exit discharge.** Exits are permitted to discharge into a fenced or walled courtyard. Enclosed yards or courts shall be of a size to accommodate all occupants, be located not less than 50 feet (15 240 mm) from the building and have an area of not less than 15 square feet (1.4 m<sup>2</sup>) per person.

**408.3.6 Exit discharge.**

**408.3.6.1 Exits are permitted to discharge into a fenced or walled courtyard.** Enclosed yards or courts shall be of a size to accommodate all occupants, a minimum of 50 feet (15 240 mm) from the building with a net area of 3 square feet (1.4 m<sup>2</sup>) per person. A gate shall be provided from the safe dispersal area to allow for the necessary relocation of occupants.

**408.3.6.2 Exterior fenced enclosures and fenced enclosures utilized for recreational or activity purposes,**

*used for exit termination for more than 20 persons, and which do not provide a safe dispersal area, shall have not less than two exits.*

**408.3.6.3 Fenced enclosure utilized for recreational or activity purposes only,** for more than 49 people, and which do not provide a safe dispersal area, shall be provided with not less than two exits.

**408.3.6.4 Fenced enclosures located on roofs of buildings one or more stories in height shall be provided with not less than two exits regardless of occupant load.**

**408.3.6.5 Fenced enclosures utilized for central control buildings not normally occupied and not accessed by inmates or the general public are permitted to have only one exit from the fenced enclosure.** These fenced enclosures shall only be occupied during emergency response conditions by not more than 29 prison staff occupants. Access to the fenced area shall be controlled remotely or at the gate with a key.

**408.3.7 Sallyports.** A sallyport shall be permitted in a means of egress where there are provisions for continuous and unobstructed passage through the sallyport during an emergency egress condition.

**408.3.8 Interior exit stairway and ramp construction.** One interior exit stairway or ramp in each building shall be permitted to have glazing installed in doors and interior walls at each landing level providing access to the interior exit stairway or ramp, provided that the following conditions are met:

1. The interior exit stairway or ramp shall not serve more than four floor levels.
2. Exit doors shall be not less than  $\frac{3}{4}$ -hour fire door assemblies complying with Section 716.5.
3. The total area of glazing at each floor level shall not exceed 5,000 square inches (3.2 m<sup>2</sup>) and individual panels of glazing shall not exceed 1,296 square inches (0.84 m<sup>2</sup>).
4. The glazing shall be protected on both sides by an automatic sprinkler system. The sprinkler system shall be designed to wet completely the entire surface of any glazing affected by fire when actuated.
5. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
6. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

**408.3.8.1 Where the number and arrangement of exits complies with the requirements of Chapter 10, other stairways which occur within the secure area of the detention facility and are not used for required exiting but are used primarily for the movement of inmates and security staff need not extend to the exterior.**

**408.3.9 Dead-end balconies.** Exit balconies serving cell tiers shall not extend more than 50 feet (15 240 mm) beyond an exit stairway.

**408.3.10 Travel distance.** The travel distance may be increased to 300 feet for portions of Group I-3 occupancies open only to staff or where inmates are escorted at all times by staff.

**408.3.11 Number of exits required.** In temporary holding areas of noncombustible construction, a second means of egress is required when the occupant load is greater than 20.

**408.4 Locks.** Egress doors are permitted to be locked in accordance with the applicable use condition. Doors from a refuge area to the outside are permitted to be locked with a key in lieu of locking methods described in Section 408.4.1. The keys to unlock the exterior doors shall be available at all times and the locks shall be operable from both sides of the door. Security hardware may be used on any fire-rated door.

**408.4.1 Remote release.** Remote release of locks on doors in a means of egress shall be provided with reliable means of operation, remote from the resident living areas, to release locks on all required doors. In Occupancy Conditions 3 or 4, the arrangement, accessibility and security of the release mechanisms required for egress shall be such that with the minimum available staff at any time, the lock mechanisms are capable of being released within 2 minutes.

**Exception:** Provisions for remote locking and unlocking of occupied rooms in Occupancy Condition 4 are not required provided that not more than 10 locks are necessary to be unlocked in order to move occupants from one smoke compartment to a refuge area within 3 minutes. The opening of necessary locks shall be accomplished with not more than two separate keys.

**408.4.2 Power-operated doors and locks.** Power-operated sliding doors or power-operated locks for swinging doors shall be operable by a manual release mechanism at the door, and either emergency power or a remote mechanical operating release shall be provided.

**Exception:** Emergency power is not required in facilities with 10 or fewer locks complying with the exception to Section 408.4.1.

**408.4.3 Redundant operation.** Mechanically operated sliding doors or mechanically operated locks shall be provided with a mechanically operated release mechanism at each door and shall be provided with a remote release control.

**408.4.4 Relock capability.** Doors remotely unlocked under emergency conditions shall not automatically relock when closed unless specific action is taken at the remote location to enable doors to relock.

**408.5 Protection of vertical openings.** Any vertical opening shall be protected by a shaft enclosure in accordance with Section 713, or shall be in accordance with Section 408.5.1.

**408.5.1 Floor openings.** The open space in front of a cell tier and connected chases, not exceeding two tiers in

height, shall not be considered a vertical shaft and need not meet the fire-resistive shaft enclosure requirements of Section 708.

#### **408.5.2 Shaft openings in communicating floor levels.**

Where a floor opening is permitted between communicating floor levels of a housing unit in accordance with Section 408.5.1, plumbing chases serving vertically stacked individual cells contained with the housing unit shall be permitted without a shaft enclosure.

**408.6 Smoke barrier.** Occupancies in Group I-3 shall have smoke barriers complying with Sections 408.8 and 709 to divide every story occupied by residents for sleeping, or any other story having an occupant load of 50 or more persons, into no fewer than two smoke compartments.

**Exception:** Spaces having a direct exit to one of the following, provided that the locking arrangement of the doors involved complies with the requirements for doors at the smoke barrier for the use condition involved:

1. A public way.
2. A building separated from the resident housing area by a 2-hour fire-resistance-rated assembly or 50 feet (15 240 mm) of open space.
3. A secured yard or court having a holding space 50 feet (15 240 mm) from the housing area that provides 6 square feet (0.56 m<sup>2</sup>) or more of refuge area per occupant, including residents, staff and visitors.
4. Holding facility.

**408.6.1 Smoke compartments.** The number of residents in any smoke compartment shall be not more than 200. The travel distance to a door in a smoke barrier from any room door required as exit access shall be not greater than 150 feet (45 720 mm). The travel distance to a door in a smoke barrier from any point in a room shall be not greater than 200 feet (60 960 mm).

**Exception:** The travel distance may be increased by 50 feet from areas open only to the staff.

**408.6.2 Refuge area.** Not less than 6 net square feet (0.56 m<sup>2</sup>) per occupant shall be provided on each side of each smoke barrier for the total number of occupants in adjoining smoke compartments. This space shall be readily available wherever the occupants are moved across the smoke barrier in a fire emergency.

**408.6.3 Independent egress.** A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originates.

**408.7 Security glazing.** In occupancies in Group I-3, windows and doors in 1-hour fire barriers constructed in accordance with Section 707, fire partitions constructed in accordance with Section 708 and smoke barriers constructed in accordance with Section 709 shall be permitted to have security glazing installed provided that the following conditions are met.

1. Individual panels of glazing shall not exceed 1,296 square inches (0.84 m<sup>2</sup>).

2. The glazing shall be protected on both sides by an automatic sprinkler system. The sprinkler system shall be designed to, when actuated, wet completely the entire surface of any glazing affected by fire.
3. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
4. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

> **408.8 Subdivision of areas.** *Each cell complex shall be separated from other cell complexes or other spaces by a smoke-tight partition.*

**408.8.1 Smoke-tight doors.** Doors in openings in partitions required to be smoke tight by Section 408.8 shall be substantial doors, of construction that will resist the passage of smoke. Latches and door closures are not required on cell doors.

> **408.9 Windowless buildings.** For the purposes of this section, a windowless building or portion of a building is one with nonopenable windows, windows not readily breakable or without windows.

**408.9.1 Smoke venting.** *Windowless buildings containing use conditions 3, 4 or 5 shall be provided with an engineered smoke control system in accordance with Section 909, windows or doors, smoke vents, or equivalent means to provide a tenable environment for exiting from the smoke compartment in the area of fire origin. If windows or doors are used to meet this section, at least two windows or doors to the exterior must be provided at or above the highest occupied level in each smoke compartment, and the windows or doors must be operable or readily breakable and arranged to manually vent smoke.*

**Exceptions:**

1. Local adult detention facilities, CDCR and CDCR mental health housing facilities shall be exempt from this section when they meet each of the following criteria:
  - 1.1. Are Type I-B or I-A construction
  - 1.2. Are protected with sprinklers throughout in accordance with Section 903.1.1
  - 1.3. Include a fire alarm system with smoke detection in accordance with NFPA 72 in the day-room and/or corridor serving as exit access from the cells, reporting to a 24 hour central control at the institution
  - 1.4. Include at least one exit from each housing unit that discharges directly to the exterior
  - 1.5. The building is divided into at least two smoke compartments per Section 408.6.1
  - 1.6. Staffing in the institution is sufficient to evacuate inmates from the smoke compartment 24 hours per day, as approved by the enforcing

*agency or the facility is provided with gang or electric locks.*

2. No venting or smoke control is required when an engineering analysis shows an acceptable safe egress time compared to the onset of untenable conditions within a windowless building or portion of a windowless building and approved by the enforcing agency.

**[F] 408.10 Fire alarm system.** A fire alarm system shall be provided in accordance with Section 907.2.6.3.

**[F] 408.11 Automatic sprinkler system.** Group I-3 occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.6.

**408.12 Emergency and standby power systems.** *Special electrical systems, exit illumination, power installations and alternate on-site electrical supplies shall be provided for every building or portion of a building housing 10 or more inmates in a detention or correctional facility in accordance with the provisions of the California Electrical Code. There shall be a source of emergency power in all detention facilities capable of providing minimal lighting in all housing units, activity areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems.*

**408.13 Windows.** *In security areas within cell complexes sprinklered throughout, the area of glazing in one-hour corridor walls and smoke barrier walls shall not be restricted, provided:*

1. All openings are protected by fixed glazing listed and labeled for a fire-protection of at least  $\frac{3}{4}$  hour; or
2. Fixed security glazing set in noncombustible frames. Shall comply with the minimum requirements of one of the following test standards: ASTM F 1233-98, Class III glass, or; California Department of Corrections, CDC 860-94d, or H.P. White Laboratory, Inc., HPW-TP- 0500.02, Forced Entry Level III.
3. In lieu of the sizes set forth in CBC, the size and area of glazed assemblies shall conform to the following: Windows required to have a three-fourths-hour fire-resistive rating or windows protected by fixed security glazing, as delineated in Items 1 and 2 above, may have an area not greater than 84 square feet (7.8 m<sup>2</sup>) with neither width nor height exceeding 12 feet (3658 mm).

**408.14 Safety padding.** *Padding material used on walls, floors and ceilings in Group I and R-2.1 occupancies shall be of an approved type tested in accordance with the procedures established by State Fire Marshal Standard 12-8-100, Room Fire Test for Wall and Ceiling Materials, California Code of Regulations, Title 24, Part 12.*

**408.15 Small management yards.**

**408.15.1 General.** *The provisions of Sections 408.15.1 through 408.15.4 shall apply to small management yards. Small management yards may be used by a maximum of two occupants at any one time for a maximum of 2 hours per day.*

**408.15.2 Construction.** *Small management yards shall be constructed in accordance with all of the following:*

1. *Constructed of Type IB noncombustible materials.*
2. *Fence material shall be noncombustible.*
3. *Have a maximum area of 150 square feet (14 m<sup>2</sup>).*
4. *Yard area covering shall not exceed 75 square feet (7 m<sup>2</sup>) or a maximum of 50 percent of the fenced enclosure.*
5. *Electrical lighting or devices of any type shall not be permitted within the yard.*

*Exception: Low voltage devices dedicated for the operation of toilets.*

**408.15.3 Fire protection system provisions.**

**408.15.3.1 Automatic sprinkler systems.** *An automatic sprinkler system shall be provided in accordance with Section 903.1.1*

*Exception: Small management yards where a distance of 10 feet (3048 mm) is maintained from all buildings or structures and 4 feet (1220 mm) is maintained from containment fencing.*

**408.15.3.2 Fire alarm systems.** *An approved fire alarm system shall be provided in accordance with Section 907.*

*Exception: Small management yards where a distance of 10 feet (3048 mm) is maintained from all buildings or structures and 4 feet (1220 mm) is maintained from containment fencing.*

**408.15.4 Means of egress.** *Except as modified or as provided for in this section, the provisions of Section 408.3 and Chapter 10 shall apply. Small management yards shall comply with all of the following:*

1. *Staff-controlled manual released locks shall be provided.*
2. *Staff escorting inmates to and from small management yards shall be equipped with radios and personal alarms to notify central control in case of a fire.*
3. *The safe dispersal area as defined by Section 1027.6 shall not be reduced due to placement of these yards.*
4. *An exit, remote from the main entrance is required in the containment fencing.*

**408.15.5 Secial provisions.** *Inmate exercise clothing and toilet paper tissue shall be the only combustibles materials permitted in small management yards.*

## SECTION 409 MOTION PICTURE PROJECTION ROOMS

**409.1 General.** The provisions of Sections 409.1 through 409.5 shall apply to rooms in which ribbon-type cellulose acetate or other safety film is utilized in conjunction with electric arc, xenon or other light-source projection equipment that develops hazardous gases, dust or radiation. Where cellu-

lose nitrate film is utilized or stored, such rooms shall comply with NFPA 40.

**409.1.1 Projection room required.** Every motion picture machine projecting film as mentioned within the scope of this section shall be enclosed in a projection room. Appurtenant electrical equipment, such as rheostats, transformers and generators, shall be within the projection room or in an adjacent room of equivalent construction.

**409.2 Construction of projection rooms.** Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located. Openings are not required to be protected.

The room shall have a floor area of not less than 80 square feet (7.44 m<sup>2</sup>) for a single machine and not less than 40 square feet (3.7 m<sup>2</sup>) for each additional machine. Each motion picture projector, floodlight, spotlight or similar piece of equipment shall have a clear working space of not less than 30 inches by 30 inches (762 mm by 762 mm) on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors. The projection room and the rooms appurtenant thereto shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). The aggregate of openings for projection equipment shall not exceed 25 percent of the area of the wall between the projection room and the auditorium. Openings shall be provided with glass or other approved material, so as to close completely the opening.

**409.3 Projection room and equipment ventilation.** Ventilation shall be provided in accordance with the *California Mechanical Code*.

**409.3.1 Supply air.** Each projection room shall be provided with adequate air supply inlets so arranged as to provide well-distributed air throughout the room. Air inlet ducts shall provide an amount of air equivalent to the amount of air being exhausted by projection equipment. Air is permitted to be taken from the outside; from adjacent spaces within the building, provided the volume and infiltration rate is sufficient; or from the building air-conditioning system, provided it is so arranged as to provide sufficient air when other systems are not in operation.

**409.3.2 Exhaust air.** Projection rooms are permitted to be exhausted through the lamp exhaust system. The lamp exhaust system shall be positively interconnected with the lamp so that the lamp will not operate unless there is the required airflow. Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into any air supply system. The projection room ventilation system is permitted to also serve appurtenant rooms, such as the generator and rewind rooms.

**409.3.3 Projection machines.** Each projection machine shall be provided with an exhaust duct that will draw air from each lamp and exhaust it directly to the outside of the building. The lamp exhaust is permitted to serve to exhaust air from the projection room to provide room air circulation. Such ducts shall be of rigid materials, except for a flexible connector approved for the purpose. The pro-

jection lamp or projection room exhaust system, or both, is permitted to be combined but shall not be interconnected with any other exhaust or return system, or both, within the building.

**409.4 Lighting control.** Provisions shall be made for control of the auditorium lighting and the means of egress lighting systems of theaters from inside the projection room and from not less than one other convenient point in the building.

**409.5 Miscellaneous equipment.** Each projection room shall be provided with rewind and film storage facilities.

## SECTION 410 STAGES, PLATFORMS AND TECHNICAL PRODUCTION AREAS

**410.1 Applicability.** The provisions of Sections 410.1 through 410.8 shall apply to all parts of buildings and structures that contain stages or platforms and similar appurtenances as herein defined.

**410.2 Definitions.** The following terms are defined in Chapter 2:

**PLATFORM.**

**PROCENIUM WALL.**

**STAGE.**

**TECHNICAL PRODUCTION AREA.**

**410.3 Stages.** Stage construction shall comply with Sections 410.3.1 through 410.3.8.

**410.3.1 Stage construction.** Stages shall be constructed of materials as required for floors for the type of construction of the building in which such stages are located.

**Exception:** Stages need not be constructed of the same materials as required for the type of construction provided the construction complies with one of the following:

1. Stages of Type IIB or IV construction with a nominal 2-inch (51 mm) wood deck, provided that the stage is separated from other areas in accordance with Section 410.3.4.
2. In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided the space below the stage is equipped with an automatic sprinkler system or fire-extinguishing system in accordance with Section 903 or 904.
3. In all types of construction, the finished floor shall be constructed of wood or approved non-combustible materials. Openings through stage floors shall be equipped with tight-fitting, solid wood trap doors with approved safety locks.

**410.3.1.1 Stage height and area.** Stage areas shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height shall be measured from the low-

est point on the stage floor to the highest point of the roof or floor deck above the stage.

**410.3.2 Technical production areas: galleries, gridirons and catwalks.** Beams designed only for the attachment of portable or fixed theater equipment, gridirons, galleries and catwalks shall be constructed of approved materials consistent with the requirements for the type of construction of the building; and a fire-resistance rating shall not be required. These areas shall not be considered to be floors, stories, mezzanines or levels in applying this code.

**Exception:** Floors of fly galleries and catwalks shall be constructed of any approved material.

**410.3.3 Exterior stage doors.** Where protection of openings is required, exterior exit doors shall be protected with fire door assemblies that comply with Section 716. Exterior openings that are located on the stage for means of egress or loading and unloading purposes, and that are likely to be open during occupancy of the theater, shall be constructed with vestibules to prevent air drafts into the auditorium.

**410.3.4 Proscenium wall.** Where the stage height is greater than 50 feet (15 240 mm), all portions of the stage shall be completely separated from the seating area by a proscenium wall with not less than a 2-hour fire-resistance rating extending continuously from the foundation to the roof.

**410.3.5 Proscenium curtain.** Where a proscenium wall is required to have a fire-resistance rating, the stage opening shall be provided with a fire curtain complying with NFPA 80 or an approved water curtain complying with Section 903.3.1.1 or, in facilities not utilizing the provisions of smoke-protected assembly seating in accordance with Section 1028.6.2, a smoke control system complying with Section 909 or natural ventilation designed to maintain the smoke level not less than 6 feet (1829 mm) above the floor of the means of egress.

**410.3.6 Scenery.** Combustible materials used in sets and scenery shall meet the fire propagation performance criteria of NFPA 701, in accordance with Section 806 and the *California Fire Code*. Foam plastics and materials containing foam plastics shall comply with Section 2603 and the *California Fire Code*.

**410.3.7 Stage ventilation.** Emergency ventilation shall be provided for stages larger than 1,000 square feet (93 m<sup>2</sup>) in floor area, or with a stage height greater than 50 feet (15 240 mm). Such ventilation shall comply with Section 410.3.7.1 or 410.3.7.2.

**410.3.7.1 Roof vents.** Two or more vents constructed to open automatically by approved heat-activated devices and with an aggregate clear opening area of not less than 5 percent of the area of the stage shall be located near the center and above the highest part of the stage area. Supplemental means shall be provided for manual operation of the ventilator. Curbs shall be provided as required for skylights in Section 2610.2. Vents shall be labeled.

**[F] 410.3.7.2 Smoke control.** Smoke control in accordance with Section 909 shall be provided to maintain the smoke layer interface not less than 6 feet (1829 mm) above the highest level of the assembly seating or above the top of the proscenium opening where a proscenium wall is provided in compliance with Section 410.3.4.

**410.4 Platform construction.** Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located. Permanent platforms are permitted to be constructed of fire-retardant-treated wood for Types I, II and IV construction where the platforms are not more than 30 inches (762 mm) above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet (279 m<sup>2</sup>) in area. Where the space beneath the permanent platform is used for storage or any purpose other than equipment, wiring or plumbing, the floor assembly shall be not less than 1-hour fire-resistance-rated construction. Where the space beneath the permanent platform is used only for equipment, wiring or plumbing, the underside of the permanent platform need not be protected.

**410.4.1 Temporary platforms.** Platforms installed for a period of not more than 30 days are permitted to be constructed of any materials permitted by the code. The space between the floor and the platform above shall only be used for plumbing and electrical wiring to platform equipment.

**410.5 Dressing and appurtenant rooms.** Dressing and appurtenant rooms shall comply with Sections 410.5.1 and 410.5.2.

**410.5.1 Separation from stage.** The stage shall be separated from dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage and other parts of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than 2 hours for stage heights greater than 50 feet (15 240 mm) and not less than 1 hour for stage heights of 50 feet (15 240 mm) or less.

**410.5.2 Separation from each other.** Dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage shall be separated from each other by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**410.6 Means of egress.** Except as modified or as provided for in this section, the provisions of Chapter 10 shall apply.

**410.6.1 Arrangement.** Where two or more exits or exit access doorways from the stage are required in accordance with Section 1015.1, no fewer than one exit or exit access doorway shall be provided on each side of a stage.

**410.6.2 Stairway and ramp enclosure.** Exit access stairways and ramps serving a stage or platform are not

required to be enclosed. Exit access stairways serving technical production areas are not required to be enclosed.

**410.6.3 Technical production areas.** Technical production areas shall be provided with means of egress and means of escape in accordance with Sections 410.6.3.1 through 410.6.3.5.

**410.6.3.1 Means of egress.** No fewer than one means of egress shall be provided from technical production areas.

**410.6.3.2 Travel distance.** The length of exit access travel shall be not greater than 300 feet (91 440 mm) for buildings without a sprinkler system and 400 feet (121 900 mm) for buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**410.6.3.3 Two means of egress.** Where two means of egress are required, the common path of travel shall be not greater than 100 feet (30 480 mm).

**Exception:** A means of escape to a roof in place of a second means of egress is permitted.

**410.6.3.4 Path of egress travel.** The following exit access components are permitted where serving technical production areas:

1. Stairways.
2. Ramps.
3. Spiral stairways.
4. Catwalks.
5. Alternating tread devices.
6. Permanent ladders.

**410.6.3.5 Width.** The path of egress travel within and from technical support areas shall be not less than 22 inches (559 mm).

**[F] 410.7 Automatic sprinkler system.** Stages shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1. Sprinklers shall be installed under the roof and gridiron and under all catwalks and galleries over the stage. Sprinklers shall be installed in dressing rooms, performer lounges, shops and storerooms accessory to such stages.

**Exceptions:**

1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height that are utilized exclusively for storage of tables and chairs, provided the concealed space is separated from the adjacent spaces by not Type X gypsum board not less than  $\frac{5}{8}$ -inch (15.9 mm) in thickness.
2. Sprinklers are not required for stages 1,000 square feet (93 m<sup>2</sup>) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.
3. Sprinklers are not required within portable orchestra enclosures on stages.

**[F] 410.8 Standpipes.** Standpipe systems shall be provided in accordance with Section 905.

## SECTION 411 SPECIAL AMUSEMENT BUILDINGS

**411.1 General.** Special amusement buildings having an occupant load of 50 or more shall comply with the requirements for the appropriate Group A occupancy and Sections 411.1 through 411.8. Amusement buildings having an occupant load of less than 50 shall comply with the requirements for a Group B occupancy and Sections 411.1 through 411.8.

**Exception:** Amusement buildings or portions thereof that are without walls or a roof and constructed to prevent the accumulation of smoke need not comply with this section.

For flammable decorative materials, see the *California Fire Code*.

**411.2 Definition.** The following term is defined in Chapter 2:

### SPECIAL AMUSEMENT BUILDING.

**[F] 411.3 Automatic fire detection.** Special amusement buildings shall be equipped with an automatic fire detection system in accordance with Section 907.

**[F] 411.4 Automatic sprinkler system.** Special amusement buildings shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where the special amusement building is temporary, the sprinkler water supply shall be of an approved temporary means.

**Exception:** Automatic sprinklers are not required where the total floor area of a temporary special amusement building is less than 1,000 square feet (93 m<sup>2</sup>) and the travel distance from any point to an exit is less than 50 feet (15 240 mm).

**[F] 411.5 Alarm.** Actuation of a single smoke detector, the automatic sprinkler system or other automatic fire detection device shall immediately sound an alarm at the building at a constantly attended location from which emergency action can be initiated including the capability of manual initiation of requirements in Section 907.2.12.2.

**[F] 411.6 Emergency voice/alarm communications system.** An emergency voice/alarm communications system shall be provided in accordance with Sections 907.2.12 and 907.5.2.2, which is also permitted to serve as a public address system and shall be audible throughout the entire special amusement building.

**411.7 Exit marking.** Exit signs shall be installed at the required exit or exit access doorways of amusement buildings in accordance with this section and Section 1011. Approved directional exit markings shall also be provided. Where mirrors, mazes or other designs are utilized that disguise the path of egress travel such that they are not apparent, approved and listed low-level exit signs that comply with Section 1011.5, and directional path markings listed in accordance with UL 1994, shall be provided and located not more than 8 inches (203 mm) above the walking surface and on or near the path

of egress travel. Such markings shall become visible in an emergency. The directional exit marking shall be activated by the automatic fire detection system and the automatic sprinkler system in accordance with Section 907.2.12.2.

**411.7.1 Photo luminescent exit signs.** Where photo luminescent exit signs are installed, activating light source and viewing distance shall be in accordance with the listing and markings of the signs.

**411.8 Interior finish.** The interior finish shall be Class A in accordance with Section 803.1.

## SECTION 412 AIRCRAFT-RELATED OCCUPANCIES

**412.1 General.** Aircraft-related occupancies shall comply with Sections 412.1 through 412.7 and the *California Fire Code*.

**412.2 Definitions.** The following terms are defined in Chapter 2:

**FIXED BASE OPERATOR (FBO).**

**HELIPORT.**

**HELISTOP.**

**RESIDENTIAL AIRCRAFT HANGAR.**

**TRANSIENT AIRCRAFT.**

**412.3 Airport traffic control towers.** The provisions of Sections 412.3.1 through 412.3.5 shall apply to airport traffic control towers not exceeding 1,500 square feet (140 m<sup>2</sup>) per floor occupied only for the following uses:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.

**412.3.1 Type of construction.** Airport traffic control towers shall be constructed to comply with the height and area limitations of Table 412.3.2.

**TABLE 412.3.1  
HEIGHT AND AREA LIMITATIONS FOR AIRPORT TRAFFIC  
CONTROL TOWERS**

TYPE OF CONSTRUCTION	HEIGHT <sup>a</sup> (feet)	MAXIMUM AREA (square feet)
IA	Unlimited	1,500
IB	240	1,500
IIA	100	1,500
IIB	85	1,500
IIIA	65	1,500

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

a. Height to be measured from grade plane to cab floor.

**412.3.2 Egress.** Not less than one exit stairway shall be permitted for airport traffic control towers of any height provided that the occupant load per floor is not greater than 15. The stairway shall conform to the requirements of Section 1009. The stairway shall be separated from ele-

vators by a distance of not less than one-half of the diagonal of the area served measured in a straight line. The exit stairway and elevator hoistway are permitted to be located in the same shaft enclosure, provided they are separated from each other by a 4-hour fire barrier having no openings. Such stairway shall be pressurized to not less than 0.15 inch of water column (43 Pa) and not greater than 0.35 inch of water column (101 Pa) in the shaft relative to the building with stairway doors closed. Stairways need not extend to the roof as specified in Section 1009.16. The provisions of Section 403 do not apply.

**Exception:** Smokeproof enclosures as set forth in Section 1022.10 are not required where required stairways are pressurized.

**[F] 412.3.3 Automatic fire detection systems.** Airport traffic control towers shall be provided with an automatic fire detection system installed in accordance with Section 907.2.

**[F] 412.3.4 Standby power.** A standby power system that conforms to Chapter 27 shall be provided in airport traffic control towers more than 65 feet (19 812 mm) in height. Power shall be provided to the following equipment:

1. Pressurization equipment, mechanical equipment and lighting.
2. Elevator operating equipment.
3. Fire alarm and smoke detection systems.

**412.3.5 Accessibility.** *[DSA-AC] In air traffic control towers, an accessible route shall not be required to serve the cab and the equipment areas on the floor immediately below the cab.*

**412.4 Aircraft hangars.** Aircraft hangars shall be in accordance with Sections 412.4.1 through 412.4.6.

**412.4.1 Exterior walls.** Exterior walls located less than 30 feet (9144 mm) from lot lines or a public way shall have a fire-resistance rating not less than 2 hours.

**412.4.2 Basements.** Where hangars have basements, floors over basements shall be of Type IA construction and shall be made tight against seepage of water, oil or vapors. There shall be no opening or communication between basements and the hangar. Access to basements shall be from outside only.

**412.4.3 Floor surface.** Floors shall be graded and drained to prevent water or fuel from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.

**Exception:** Aircraft hangars with individual lease spaces not exceeding 2,000 square feet (186 m<sup>2</sup>) each in which servicing, repairing or washing is not conducted and fuel is not dispensed shall have floors that are graded toward the door, but shall not require a separator.

**412.4.4 Heating equipment.** Heating equipment shall be placed in another room separated by 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or

both. Entrance shall be from the outside or by means of a vestibule providing a two-doorway separation.

**Exceptions:**

1. Unit heaters and vented infrared radiant heating equipment suspended not less than 10 feet (3048 mm) above the upper surface of wings or engine enclosures of the highest aircraft that are permitted to be housed in the hangar need not be located in a separate room provided they are mounted not less than 8 feet (2438 mm) above the floor in shops, offices and other sections of the hangar communicating with storage or service areas.
2. Entrance to the separated room shall be permitted by a single interior door provided the sources of ignition in the appliances are not less than 18 inches (457 mm) above the floor.

**412.4.5 Finishing.** The process of “doping,” involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate detached building equipped with automatic fire-extinguishing equipment in accordance with Section 903.

**[F] 412.4.6 Fire suppression.** Aircraft hangars shall be provided with a fire suppression system designed in accordance with NFPA 409, based upon the classification for the hangar given in Table 412.4.6.

**Exception:** Where a fixed base operator has separate repair facilities on site, Group II hangars operated by a fixed base operator used for storage of transient aircraft only shall have a fire suppression system, but the system is exempt from foam requirements.

**[F] 412.4.6.1 Hazardous operations.** Any Group III aircraft hangar according to Table 412.4.6 that contains hazardous operations including, but not limited to, the following shall be provided with a Group I or II fire suppression system in accordance with NFPA 409 as applicable:

1. Doping.
2. Hot work including, but not limited to, welding, torch cutting and torch soldering.
3. Fuel transfer.
4. Fuel tank repair or maintenance not including defueled tanks in accordance with NFPA 409, inerted tanks or tanks that have never been fueled.
5. Spray finishing operations.
6. Total fuel capacity of all aircraft within the unsprinklered single fire area in excess of 1,600 gallons (6057 L).
7. Total fuel capacity of all aircraft within the maximum single fire area in excess of 7,500 gallons (28 390 L) for a hangar with an automatic sprinkler system in accordance with Section 903.3.1.1.



**[F] TABLE 412.4.6  
HANGAR FIRE SUPPRESSION REQUIREMENTS<sup>a,b,c</sup>**

MAXIMUM SINGLE FIRE AREA (square feet)	TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
≥ 40,001	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I
40,000	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
30,000	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
20,000	Group III	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II
15,000	Group III	Group III	Group III	Group II	Group III	Group II	Group III	Group II	Group II
12,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II	Group II
8,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II
5,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

- a. Aircraft hangars with a door height greater than 28 feet shall be provided with fire suppression for a Group I hangar regardless of maximum fire area.  
b. Groups shall be as classified in accordance with NFPA 409.  
c. Membrane structures complying with Section 3102 shall be classified as a Group IV hangar.

**[F] 412.4.6.2 Separation of maximum single fire areas.** Maximum single fire areas established in accordance with hangar classification and construction type in Table 412.4.6 shall be separated by 2-hour fire walls constructed in accordance with Section 706. In determining the maximum single fire area as set forth in Table 412.4.6, ancillary uses which are separated from aircraft servicing areas by a fire barrier of not less than one hour, constructed in accordance with Section 707 shall not be included in the area.

**412.5 Residential aircraft hangars.** Residential aircraft hangars shall comply with Sections 412.5.1 through 412.5.5.

**412.5.1 Fire separation.** A hangar shall not be attached to a dwelling unless separated by a fire barrier having a fire-resistance rating of not less than 1 hour. Such separation shall be continuous from the foundation to the underside of the roof and unpierced except for doors leading to the dwelling unit. Doors into the dwelling unit shall be equipped with self-closing devices and conform to the requirements of Section 716 with a noncombustible raised sill not less than 4 inches (102 mm) in height. Openings from a hangar directly into a room used for sleeping purposes shall not be permitted.

**412.5.2 Egress.** A hangar shall provide two means of egress. One of the doors into the dwelling shall be considered as meeting only one of the two means of egress.

**[F] 412.5.3 Smoke alarms.** Smoke alarms shall be provided within the hangar in accordance with Section 907.2.21.

**412.5.4 Independent systems.** Electrical, mechanical and plumbing drain, waste and vent (DWV) systems installed within the hangar shall be independent of the systems installed within the dwelling. Building sewer lines shall be permitted to be connected outside the structures.

**Exception:** Smoke detector wiring and feed for electrical subpanels in the hangar.

**412.5.5 Height and area limits.** Residential aircraft hangars shall be not greater than 2,000 square feet (186 m<sup>2</sup>) in area and 20 feet (6096 mm) in building height.

**[F] 412.6 Aircraft paint hangars.** Aircraft painting operations where flammable liquids are used in excess of the maximum allowable quantities per control area listed in Table 307.1(1) shall be conducted in an aircraft paint hangar that complies with the provisions of Sections 412.6.1 through 412.6.6.

**[F] 412.6.1 Occupancy group.** Aircraft paint hangars shall be classified as Group H-2. Aircraft paint hangars shall comply with the applicable requirements of this code and the *California Fire Code* for such occupancy.

**412.6.2 Construction.** The aircraft paint hangar shall be of Type I or II construction.

**[F] 412.6.3 Operations.** Only those flammable liquids necessary for painting operations shall be permitted in quantities less than the maximum allowable quantities per control area in Table 307.1(1). Spray equipment cleaning operations shall be conducted in a liquid use, dispensing and mixing room.

**[F] 412.6.4 Storage.** Storage of flammable liquids shall be in a liquid storage room.

**[F] 412.6.5 Fire suppression.** Aircraft paint hangars shall be provided with fire suppression as required by NFPA 409.

**[F] 412.6.6 Ventilation.** Aircraft paint hangars shall be provided with ventilation as required in the *California Mechanical Code*.

**[F] 412.7 Heliports and helistops.** Heliports and helistops shall be permitted to be erected on buildings or other locations where they are constructed in accordance with Sections 412.7.1 through 412.7.5.

**[F] 412.7.1 Size.** The landing area for helicopters less than 3,500 pounds (1588 kg) shall be not less than 20 feet (6096 mm) in length and width. The landing area shall be

surrounded on all sides by a clear area having a minimum average width at roof level of 15 feet (4572 mm) but with no width less than 5 feet (1524 mm).

**[F] 412.7.2 Design.** Helicopter landing areas and the supports thereof on the roof of a building shall be noncombustible construction. Landing areas shall be designed to confine any flammable liquid spillage to the landing area itself and provisions shall be made to drain such spillage away from any exit or stairway serving the helicopter landing area or from a structure housing such exit or stairway. For structural design requirements, see Section 1605.4.

**[F] 412.7.3 Means of egress.** The means of egress from heliports and helistops shall comply with the provisions of Chapter 10. Landing areas located on buildings or structures shall have two or more means of egress. For landing areas less than 60 feet (18 288 mm) in length or less than 2,000 square feet (186 m<sup>2</sup>) in area, the second means of egress is permitted to be a fire escape, alternating tread device or ladder leading to the floor below.

**[F] 412.7.4 Rooftop heliports and helistops.** Rooftop heliports and helistops shall comply with NFPA 418.

**[F] 412.7.5 Standpipe system.** In buildings equipped with a standpipe system, the standpipe shall extend to the roof level in accordance with Section 905.3.6.

### SECTION 413 COMBUSTIBLE STORAGE

**413.1 General.** High-piled stock or rack storage in any occupancy group shall comply with the *California Fire Code*.

**413.2 Attic, under-floor and concealed spaces.** Attic, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage side as required for 1-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are self-closing and are of noncombustible construction or solid wood core not less than 1<sup>3</sup>/<sub>4</sub> inch (45 mm) in thickness.

**Exception:** Neither fire resistant construction nor open protectives are required in any of the following locations:

1. Areas protected by approved automatic sprinkler systems.
2. Group R-3 and U occupancies.

### SECTION 414 HAZARDOUS MATERIALS

**[F] 414.1 General.** The provisions of Sections 414.1 through 414.7 shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of hazardous materials.

**[F] 414.1.1 Other provisions.** Buildings and structures with an occupancy in Group H shall comply with this section and the applicable provisions of Section 415 and the *California Fire Code*. For Group L occupancies see Section 443.

**[F] 414.1.2 Materials.** The safe design of hazardous material occupancies is material dependent. Individual material

requirements are also found in Sections 307 and 415, and in the *California Mechanical Code* and the *California Fire Code*.

**[F] 414.1.2.1 Aerosols.** Level 2 and 3 aerosol products shall be stored and displayed in accordance with the *California Fire Code*. See Section 311.2 and the *California Fire Code* for occupancy group requirements.

**[F] 414.1.3 Information required.** A report shall be submitted to the building official identifying the maximum expected quantities of hazardous materials to be stored, used in a closed system and used in an open system, and subdivided to separately address hazardous material classification categories based on Tables 307.1(1) and 307.1(2). The methods of protection from such hazards, including but not limited to control areas, fire protection systems and Group H occupancies shall be indicated in the report and on the construction documents. The opinion and report shall be prepared by a qualified person, firm or corporation approved by the building official and provided without charge to the enforcing agency.

For buildings and structures with an occupancy in Group H, separate floor plans shall be submitted identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure.

**[F] 414.2 Control areas.** Control areas shall comply with Sections 414.2.1 through 414.2.5 and the *California Fire Code*.

**[F] 414.2.1 Construction requirements.** Control areas shall be separated from each other by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**[F] 414.2.2 Percentage of maximum allowable quantities.** The percentage of maximum allowable quantities of hazardous materials per control area permitted at each floor level within a building shall be in accordance with Table 414.2.2.

**[F] 414.2.3 Number.** The maximum number of control areas within a building shall be in accordance with Table 414.2.2.

**[F] 414.2.4 Fire-resistance-rating requirements.** The required fire-resistance rating for fire barriers shall be in accordance with Table 414.2.2. The floor assembly of the control area and the construction supporting the floor of the control area shall have a fire-resistance rating of not less than 2 hours.

**Exception:** The floor assembly of the control area and the construction supporting the floor of the control area are allowed to be 1-hour fire-resistance rated in buildings of Types IIA, IIIA and VA construction, provided that both of the following conditions exist:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1; and
2. The building is three or fewer stories above grade plane.

**[F] TABLE 414.2.2  
DESIGN AND NUMBER OF CONTROL AREAS**

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA <sup>a</sup>	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS <sup>b</sup>
Above grade plane	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.

b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

**[F] 414.2.5 Hazardous material in Group M display and storage areas and in Group S storage areas.** The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single control area of a Group M display and storage area, a Group S storage area or an outdoor control area is permitted to exceed the maximum allowable quantities per control area specified in Tables 307.1(1) and 307.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the *California Fire Code* and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).

In Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area as indicated in Table 414.2.5(2), provided that the materials are displayed and stored in accordance with the *California Fire Code*.

The maximum quantity of aerosol products in Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with the *California Fire Code*.

**[F] 414.3 Ventilation.** Rooms, areas or spaces of Group H in which explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are or may be emitted due to the processing, use, handling or storage of materials shall be mechanically ventilated as required by the *California Fire Code* and the *California Mechanical Code*.

Ducts conveying explosives or flammable vapors, fumes or dusts shall extend directly to the exterior of the building without entering other spaces. Exhaust ducts shall not extend into or through ducts and plenums.

**Exception:** Ducts conveying vapor or fumes having flammable constituents less than 25 percent of their lower flammable limit (LFL) are permitted to pass through other spaces.

Emissions generated at workstations shall be confined to the area in which they are generated as specified in the *California Fire Code* and the *California Mechanical Code*.

The location of supply and exhaust openings shall be in accordance with the *California Mechanical Code*. Exhaust air contaminated by highly toxic material shall be treated in accordance with the *California Fire Code*.

A manual shutoff control for ventilation equipment required by this section shall be provided outside the room adjacent to the principal access door to the room. The switch shall be of the break-glass type and shall be labeled: VENTILATION SYSTEM EMERGENCY SHUTOFF.

**[F] 414.4 Hazardous material systems.** Systems involving hazardous materials shall be suitable for the intended application. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls, where provided, shall be designed to be fail safe.

**[F] 414.5 Inside storage, dispensing and use.** The inside storage, dispensing and use of hazardous materials shall be in accordance with Sections 414.5.1 through 414.5.4 of this code and the *California Fire Code*.

**[F] 414.5.1 Explosion control.** Explosion control shall be provided in accordance with the *California Fire Code* as required by Table 414.5.1 where quantities of hazardous materials specified in that table exceed the maximum allowable quantities in Table 307.1(1) or where a structure, room or space is occupied for purposes involving explosion hazards as required by Section 415 or the *California Fire Code*.

**[F] 414.5.2 Monitor control equipment.** Monitor control equipment shall be provided where required by the *California Fire Code*.

**[F] 414.5.3 Emergency or standby power.** Where mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems are required by the *California Fire Code* or this code,

**SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY**

**[F] TABLE 414.2.5(1)**  
**MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M AND S OCCUPANCIES**  
**NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS<sup>d,e,f</sup>**

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material <sup>a</sup>	Class	Solids pounds	Liquids gallons
<b>A. Health-hazard materials—nonflammable and noncombustible solids and liquids</b>			
1. Corrosives <sup>b,c</sup>	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20 <sup>b,c</sup>	2 <sup>b,c</sup>
3. Toxics <sup>b,c</sup>	Not Applicable	1,000	100
<b>B. Physical-hazard materials—nonflammable and noncombustible solids and liquids</b>			
1. Oxidizers <sup>b,c</sup>	4	Not Allowed	Not Allowed
	3	1,150 <sup>g</sup>	115
	2	2,250 <sup>h</sup>	225
	1	18,000 <sup>i,j</sup>	1,800 <sup>i,j</sup>
2. Unstable (reactives) <sup>b,c</sup>	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water reactives	3 <sup>b,c</sup>	550	55
	2 <sup>b,c</sup>	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- Hazard categories are as specified in the *California Fire Code*.
- Maximum allowable quantities shall be increased 100 percent in buildings that are sprinklered in accordance with Section 903.3.1.1. When Note c also applies, the increase for both notes shall be applied cumulatively.
- Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, in accordance with the *California Fire Code*. When Note b also applies, the increase for both notes shall be applied cumulatively.
- See Table 414.2.2 for design and number of control areas.
- Allowable quantities for other hazardous material categories shall be in accordance with Section 307.
- Maximum quantities shall be increased 100 percent in outdoor control areas.
- Maximum amounts are permitted to be increased to 2,250 pounds when individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.
- Maximum amounts are permitted to be increased to 4,500 pounds when individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.
- The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- Quantities are unlimited in an outdoor control area.

such systems shall be provided with an emergency or standby power system in accordance with Chapter 27.

**Exceptions:**

- Emergency or standby power are not required for the following storage areas:
  - Mechanical ventilation for storage of Class IB and Class IC flammable and combustible liquids in closed containers not exceeding 6.5 gallons (25 L) capacity.
  - Storage areas for Class 1 and 2 oxidizers.
  - Storage areas for Class II, III, IV and V organic peroxides.
  - Storage, use and handling areas for asphyxiant, irritant and radioactive gases.

1.5. For storage, use and handling areas for highly toxic or toxic materials, see Sections 6004.2.2.8 and 6004.3.4.2 of the *California Fire Code*.

- Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

**[F] 414.5.4 Spill control, drainage and containment.** Rooms, buildings or areas occupied for the storage of solid and liquid hazardous materials shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the *California Fire Code*. The methods of spill control shall be in accordance with the *California Fire Code*.

[F] TABLE 414.2.5(2)  
**MAXIMUM ALLOWABLE QUANTITY OF FLAMMABLE AND COMBUSTIBLE  
 LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES PER CONTROL AREA<sup>a</sup>**

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered in accordance with note b densities and arrangements	Sprinklered in accordance with Tables 3404.3.6.3(4) through 3404.3.6.3(8) and Table 3404.3.7.5.1 of the <i>California Fire Code</i>	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500 <sup>c</sup>	15,000 <sup>c</sup>	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>, 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m<sup>2</sup>.

a. Control areas shall be separated from each other by not less than a 1-hour fire barrier wall.

b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:

1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of Ordinary Hazard Group 2.
2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.

c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to a maximum of 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

**414.5.5 Hazardous material handling.** *The handling of hazardous materials shall be in accordance with California Fire Code Section 2703.10.*

[F] **414.6 Outdoor storage, dispensing and use.** The outdoor storage, dispensing and use of hazardous materials shall be in accordance with the *California Fire Code*.

[F] **414.6.1 Weather protection.** Where weather protection is provided for sheltering outdoor hazardous material storage or use areas, such areas shall be considered outdoor storage or use when the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.

[F] **414.6.1.1 Walls.** Walls shall not obstruct more than one side of the structure.

**Exception:** Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area is not greater than 25 percent of the structure's perimeter.

[F] **414.6.1.2 Separation distance.** The distance from the structure to buildings, lot lines, public ways or means of egress to a public way shall be not less than the distance required for an outside hazardous material storage or use area without weather protection.

[F] **414.6.1.3 Noncombustible construction.** The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet (140 m<sup>2</sup>).

**Exception:** The maximum area is permitted to be increased as provided by Section 506.

[F] **414.7 Emergency alarms.** Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.

[F] **414.7.1 Storage.** An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each

interior exit or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

[F] **414.7.2 Dispensing, use and handling.** Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through corridors, interior exit stairways or ramps, or exit passageways there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and exit access doorway throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall initiate a local audible alarm.

[F] **414.7.3 Supervision.** Emergency alarm systems shall be supervised by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.

## SECTION 415 GROUPS H-1, H-2, H-3, H-4 AND H-5

*Section 415 has been completely reorganized from the 2009 code; therefore, the \* and \*\* margin indicators have not been included for clarity.*

[F] **415.1 Scope.** The provisions of Sections 415.1 through 415.10 shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per control area listed in Section 307.1. Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 414 and the *California Fire Code*.

[F] **415.2 Definitions.** The following terms are defined in Chapter 2:

### CONTINUOUS GAS DETECTION SYSTEM.

**SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY**

**[F] TABLE 414.5.1  
EXPLOSION CONTROL REQUIREMENTS<sup>a</sup>**

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems <sup>b</sup>
<b>HAZARD CATEGORY</b>			
Combustible dusts <sup>c</sup>	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA <sup>d</sup>	Not Required	Required
	IB <sup>e</sup>	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable	Required	Not Permitted
	3 Nondetonable	Not Required	Required
Water-reactive liquids and solids	3	Not Required	Required
	2 <sup>g</sup>	Not Required	Required
<b>SPECIAL USES</b>			
Acetylene generator rooms	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist <sup>f</sup>	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

a. See Section 414.1.3.

b. See the *California Fire Code*.

c. As generated during manufacturing or processing.

d. Storage or use.

e. In open use or dispensing.

f. Rooms containing dispensing and use of hazardous materials when an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.

g. A method of explosion control shall be provided when Class 2 water-reactive materials can form potentially explosive mixtures.

**DETACHED BUILDING.**

**EMERGENCY CONTROL STATION.**

**EXHAUSTED ENCLOSURE.**

**FABRICATION AREA.**

**FLAMMABLE VAPORS OR FUMES.**

**GAS CABINET.**

**GASROOM.**

**HAZARDOUS PRODUCTION MATERIAL (HPM).**

**HPM FLAMMABLE LIQUID.**

**HPM ROOM.**

**IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH).**

**LIQUID.**

**LIQUID STORAGE ROOM.**

**LIQUID USE, DISPENSING AND MIXING ROOM.**

**LOWER FLAMMABLE LIMIT (LFL).**

**NORMAL TEMPERATURE AND PRESSURE (NTP).**

**PHYSIOLOGICAL WARNING THRESHOLD LEVEL.**

**SERVICE CORRIDOR.**

**SOLID.**

**STORAGE, HAZARDOUS MATERIALS.****USE (MATERIAL).****WORKSTATION.**

**[F] 415.3 Automatic fire detection systems.** Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.

**[F] 415.4 Automatic sprinkler system.** Group H occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.

**[F] 415.5 Fire separation distance.** Group H occupancies shall be located on property in accordance with the other provisions of this chapter. In Groups H-2 and H-3, not less than 25 percent of the perimeter wall of the occupancy shall be an exterior wall.

**Exceptions:**

1. Liquid use, dispensing and mixing rooms having a floor area of not more than 500 square feet (46.5 m<sup>2</sup>) need not be located on the outer perimeter of the building where they are in accordance with the *California Fire Code* and NFPA 30.
2. Liquid storage rooms having a floor area of not more than 1,000 square feet (93 m<sup>2</sup>) need not be located on the outer perimeter where they are in accordance with the *California Fire Code* and NFPA 30.
3. Spray paint booths that comply with the *California Fire Code* need not be located on the outer perimeter.

**[F] 415.5.1 Group H occupancy minimum fire separation distance.** Regardless of any other provisions, buildings containing Group H occupancies shall be set back to the minimum fire separation distance as set forth in Sections 415.5.1.1 through 415.5.1.4. Distances shall be measured from the walls enclosing the occupancy to lot lines, including those on a public way. Distances to assumed lot lines established for the purpose of determining exterior wall and opening protection are not to be used to establish the minimum fire separation distance for buildings on sites where explosives are manufactured or used when separation is provided in accordance with the quantity distance tables specified for explosive materials in the *California Fire Code*.

**[F] 415.5.1.1 Group H-1.** Group H-1 occupancies shall be set back not less than 75 feet (22 860 mm) and not less than required by the *California Fire Code*.

**Exceptions:**

1. Fireworks manufacturing buildings separated in accordance with NFPA 1124.
2. Buildings containing the following materials when separated in accordance with Table 415.3.1:
  - 2.1. Organic peroxides, unclassified detonable.
  - 2.2. Unstable reactive materials, Class 4.
  - 2.3. Unstable reactive materials, Class 3 detonable.

2.4. Detonable pyrophoric materials.

2. Group H-2. Not less than 30 feet (9144 mm) where the area of the occupancy exceeds 1,000 square feet (93 m<sup>2</sup>) and it is not required to be located in a detached building.
3. Groups H-2 and H-3. Not less than 50 feet (15 240 mm) where a detached building is required (see Table 415.3.2).
4. Groups H-2 and H-3. Occupancies containing materials with explosive characteristics shall be separated as required by the *California Fire Code*. Where separations are not specified, the distances required shall not be less than the distances required by Table 415.3.1.

**[F] 415.5.1.2 Group H-2.** Group H-2 occupancies shall be set back not less than 30 feet (9144 mm) where the area of the occupancy is greater than 1,000 square feet (93 m<sup>2</sup>) and it is not required to be located in a detached building.

**[F] 415.5.1.3 Groups H-2 and H-3.** Group H-2 and H-3 occupancies shall be set back not less than 50 feet (15 240 mm) where a detached building is required (see Table 415.3.2).

**[F] 415.5.1.4 Explosive materials.** Group H-2 and H-3 occupancies containing materials with explosive characteristics shall be separated as required by the *California Fire Code*. Where separations are not specified, the distances required shall be determined by a technical report issued in accordance with Section 414.1.3.

**[F] 415.5.2 Detached buildings for Group H-1, H-2 or H-3 occupancy.** The storage or use of hazardous materials in excess of those amounts listed in Table 415.5.2 shall be in accordance with the applicable provisions of Sections 415.6 and 415.7.

**[F] 415.5.2.1 Wall and opening protection.** Where a detached building is required by Table 415.5.2, there are no requirements for wall and opening protection based on fire separation distance.

**[F] 415.6 Special provisions for Group H-1 occupancies.** Group H-1 occupancies shall be in buildings used for no other purpose, shall not exceed one story in height and be without basements, crawl spaces or other under-floor spaces. Roofs shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature. Group H-1 occupancies containing materials that are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per control area in Table 307.1(2) shall comply with requirements for both Group H-1 and H-4 occupancies.

**[F] 415.6.1 Floors in storage rooms.** Floors in storage areas for organic peroxides, pyrophoric materials and unstable (reactive) materials shall be of liquid-tight, non-combustible construction.

**[F] 415.7 Special provisions for Group H-2 and H-3 occupancies.** Group H-2 and H-3 occupancies containing quantities of hazardous materials in excess of those set forth in

**[F] TABLE 415.5.2  
DETACHED BUILDING REQUIRED**

A DETACHED BUILDING IS REQUIRED WHEN THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED HEREIN			
Material	Class	Solids and Liquids (tons) <sup>a, b</sup>	Gases (cubic feet) <sup>a, b</sup>
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4 <sup>c</sup> Division 1.5 Division 1.6	Maximum Allowable Quantity Maximum Allowable Quantity Maximum Allowable Quantity Maximum Allowable Quantity 1 Maximum Allowable Quantity Maximum Allowable Quantity	Not Applicable
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	Not Applicable
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	Not Applicable
	Class II	25	Not Applicable
	Class III	50	Not Applicable
Unstable (reactives) nondetonable	Class 3	1	2,000
	Class 2	25	10,000
Water reactives	Class 3	1	Not Applicable
	Class 2	25	Not Applicable
Pyrophoric gases	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 m<sup>3</sup>, 1 pound = 0.454 kg.

- a. For materials that are detonable, the distance to other buildings or lot lines shall be in accordance with Chapter 33 of the *California Fire Code* based on trinitrotoluene (TNT) equivalence of the material. For materials classified as explosives, see Chapter 56 of the *California Fire Code*.
- b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 307.1(1).
- c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, provided the net explosive weight of individual articles does not exceed 1 pound.

Table 415.5.2 shall be in detached buildings used for manufacturing, processing, dispensing, use or storage of hazardous materials. Materials listed for Group H-1 occupancies in Section 307.3 are permitted to be located within Group H-2 or H-3 detached buildings provided the amount of materials per control area do not exceed the maximum allowed quantity specified in Table 307.1(1).

**[F] 415.7.1 Detached buildings.** Detached buildings shall not exceed one story in height and shall be without basements, crawl spaces or other under-floor spaces.

**[F] 415.7.2 Multiple hazards.** Group H-2 or H-3 occupancies containing materials which are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per control area in Table 307.1(2) shall comply with requirements for Group H-2, H-3 or H-4 occupancies as applicable.

**[F] 415.7.3 Separation of incompatible materials.** Hazardous materials other than those listed in Table 415.3.2 shall be allowed in manufacturing, processing, dispensing, use or storage areas when separated from incompatible materials in accordance with the provisions of the *California Fire Code*.

**[F] 415.7.4 Water reactives.** Group H-2 and H-3 occupancies containing water-reactive materials shall be resis-

tant to water penetration. Piping for conveying liquids shall not be over or through areas containing water reactives, unless isolated by approved liquid-tight construction.

**Exception:** Fire protection piping shall be permitted over or through areas containing water reactives without isolating it with liquid-tight construction.

**[F] 415.7.5 Floors in storage rooms.** Floors in storage areas for organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials and water-reactive solids and liquids shall be of liquid-tight, noncombustible construction.

**[F] 415.7.6 Waterproof room.** Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than approved automatic sprinkler systems shall not be within such rooms or areas.

**[F] 415.8 Group H-2.** Occupancies in Group H-2 shall be constructed in accordance with Sections 415.8.1 through 415.8.4 and the *California Fire Code*.

**[F] 415.8.1 Combustible dusts, grain processing and storage.** The provisions of Sections 415.8.1.1 through 415.8.1.6 shall apply to buildings in which materials that



produce combustible dusts are stored or handled. Buildings that store or handle combustible dusts shall comply with the applicable provisions of NFPA 61, NFPA 85, NFPA 120, NFPA 484, NFPA 654, NFPA 655 and NFPA 664, and the *California Fire Code*.

**[F] 415.8.1.1 Type of construction and height exceptions.** Buildings shall be constructed in compliance with the height and area limitations of Table 503 for Group H-2; except that where erected of Type I or II construction, the heights and areas of grain elevators and similar structures shall be unlimited, and where of Type IV construction, the maximum building height shall be 65 feet (19 812 mm) and except further that, in isolated areas, the maximum building height of Type IV structures shall be increased to 85 feet (25 908 mm).

**[F] 415.8.1.2 Grinding rooms.** Every room or space occupied for grinding or other operations that produce combustible dusts shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating of the enclosure shall be not less than 2 hours where the area is not more than 3,000 square feet (279 m<sup>2</sup>), and not less than 4 hours where the area is greater than 3,000 square feet (279 m<sup>2</sup>).

**[F] 415.8.1.3 Conveyors.** Conveyors, chutes, piping and similar equipment passing through the enclosures of rooms or spaces shall be constructed dirt tight and vapor tight, and be of approved noncombustible materials complying with Chapter 30.

**[F] 415.8.1.4 Explosion control.** Explosion control shall be provided as specified in the *California Fire Code*, or spaces shall be equipped with the equivalent mechanical ventilation complying with the *California Mechanical Code*.

**[F] 415.8.1.5 Grain elevators.** Grain elevators, malt houses and buildings for similar occupancies shall not be located within 30 feet (9144 mm) of interior lot lines or structures on the same lot, except where erected along a railroad right-of-way.

**[F] 415.8.1.6 Coal pockets.** Coal pockets located less than 30 feet (9144 mm) from interior lot lines or from structures on the same lot shall be constructed of not less than Type IB construction. Where more than 30 feet (9144mm) from interior lot lines, or where erected along a railroad right-of-way, the minimum type of construction of such structures not more than 65 feet (19 812 mm) in building height shall be Type IV.

**[F] 415.8.2 Flammable and combustible liquids.** The storage, handling, processing and transporting of flammable and combustible liquids in Groups H-2 and H-3 occupancies shall be in accordance with Sections 415.8.2.1 through 415.8.2.9, the *California Mechanical Code* and the *California Fire Code*.

**[F] 415.8.2.1 Mixed occupancies.** Where the storage tank area is located in a building of two or more occu-

pancies and the quantity of liquid exceeds the maximum allowable quantity for one control area, the use shall be completely separated from adjacent occupancies in accordance with the requirements of Section 508.4.

**[F] 415.8.2.1.1 Height exception.** Where storage tanks are located within a building no more than one story above grade plane, the height limitation of Section 503 shall not apply for Group H.

**[F] 415.8.2.2 Tank protection.** Storage tanks shall be noncombustible and protected from physical damage. Fire barriers or horizontal assemblies or both around the storage tanks shall be permitted as the method of protection from physical damage.

**[F] 415.8.2.3 Tanks.** Storage tanks shall be approved tanks conforming to the requirements of the *California Fire Code*.

**[F] 415.8.2.4 Leakage containment.** A liquid-tight containment area compatible with the stored liquid shall be provided. The method of spill control, drainage control and secondary containment shall be in accordance with the *California Fire Code*.

**Exception:** Rooms where only double-wall storage tanks conforming to Section 415.8.2.3 are used to store Class I, II and IIIA flammable and combustible liquids shall not be required to have a leakage containment area.

**[F] 415.8.2.5 Leakage alarm.** An approved automatic alarm shall be provided to indicate a leak in a storage tank and room. The alarm shall sound an audible signal, 15 dBA above the ambient sound level, at every point of entry into the room in which the leaking storage tank is located. An approved sign shall be posted on every entry door to the tank storage room indicating the potential hazard of the interior room environment, or the sign shall state: WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS. The leakage alarm shall also be supervised in accordance with Chapter 9 to transmit a trouble signal.

**[F] 415.8.2.6 Tank vent.** Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the *California Fire Code*.

**[F] 415.8.2.7 Room ventilation.** Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical ventilation. The mechanical ventilation system shall be in accordance with the *California Mechanical Code* and the *California Fire Code*.

**[F] 415.8.2.8 Explosion venting.** Where Class I liquids are being stored, explosion venting shall be provided in accordance with the *California Fire Code*.

**[F] 415.8.2.9 Tank openings other than vents.** Tank openings other than vents from tanks inside buildings shall be designed to ensure that liquids or vapor concentrations are not released inside the building.

**[F] 415.8.3 Liquefied petroleum gas facilities.** The construction and installation of liquefied petroleum gas facilities shall be in accordance with the requirements of this code, the *California Fire Code*, the *California Mechanical Code*, the *California Plumbing Code* and NFPA 58.

**[F] 415.8.4 Dry cleaning plants.** The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, the *California Mechanical Code*, the *California Plumbing Code* and NFPA 32. Dry cleaning solvents and systems shall be classified in accordance with the *California Fire Code*.

**[F] 415.9 Groups H-3 and H-4.** Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of this code and the *California Fire Code*.

**[F] 415.9.1 Flammable and combustible liquids.** The storage, handling, processing and transporting of flammable and combustible liquids in Group H-3 occupancies shall be in accordance with Section 415.8.2.

**[F] 415.9.2 Gas rooms.** Where gas rooms are provided, such rooms shall be separated from other areas by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**[F] 415.9.3 Floors in storage rooms.** Floors in storage areas for corrosive liquids and highly toxic or toxic materials shall be of liquid-tight, noncombustible construction.

**[F] 415.9.4 Separation-highly toxic solids and liquids.** Highly toxic solids and liquids not stored in approved hazardous materials storage cabinets shall be isolated from other hazardous materials storage by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**[F] 415.10 Group H-5.** In addition to the requirements set forth elsewhere in this code, Group H-5 shall comply with the provisions of Sections 415.10.1 through 415.10.11 and the *California Fire Code*.

**[F] 415.10.1 Fabrication areas.** Fabrication areas shall comply with Sections 415.10.1.1 through 415.10.1.8.

**[F] 415.10.1.1 Hazardous materials.** Hazardous materials and hazardous production materials (HPM) shall comply with Sections 415.10.1.1.1 and 415.10.1.1.2.

**[F] 415.10.1.1.1 Aggregate quantities.** The aggregate quantities of hazardous materials stored and used in a single fabrication area shall not exceed the quantities set forth in Table 415.10.1.1.1.

**Exception:** The quantity limitations for any hazard category in Table 415.10.1.1.1 shall not apply where the fabrication area contains quantities of hazardous materials not exceeding the maximum

allowable quantities per control area established by Tables 307.1(1) and 307.1(2).

**[F] 415.10.1.1.2 Hazardous production materials.** The maximum quantities of hazardous production materials (HPM) stored in a single fabrication area shall not exceed the maximum allowable quantities per control area established by Tables 307.1(1) and 307.1(2).

**[F] 415.10.1.2 Separation.** Fabrication areas, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.10.1.1.1, shall be separated from each other, from corridors and from other parts of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. Doors within such fire barrier walls, including doors to corridors, shall be only self-closing fire door assemblies having a fire protection rating of not less than  $\frac{3}{4}$  hour.
2. Windows between fabrication areas and corridors are permitted to be fixed glazing listed and labeled for a fire protection rating of not less than  $\frac{3}{4}$  hour in accordance with Section 716.

**[F] 415.10.1.3 Location of occupied levels.** Occupied levels of fabrication areas shall be located at or above the first story above grade plane.

**[F] 415.10.1.4 Floors.** Except for surfacing, floors within fabrication areas shall be of noncombustible construction.

Openings through floors of fabrication areas are permitted to be unprotected where the interconnected levels are used solely for mechanical equipment directly related to such fabrication areas (see also Section 415.10.1.5).

Floors forming a part of an occupancy separation shall be liquid tight.

**[F] 415.10.1.5 Shafts and openings through floors.** Elevator hoistways, vent shafts and other openings through floors shall be enclosed where required by Sections 712 and 713. Mechanical, duct and piping penetrations within a fabrication area shall not extend through more than two floors. The annular space around penetrations for cables, cable trays, tubing, piping, conduit or ducts shall be sealed at the floor level to restrict the movement of air. The fabrication area, including the areas through which the ductwork and piping extend, shall be considered a single conditioned environment.

**SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY**

**[F] TABLE 415.10.1.1.1  
QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5<sup>a</sup>**

HAZARD CATEGORY		SOLIDS (pounds per square foot)	LIQUIDS (gallons per square foot)	GAS (cubic feet @ NTP/square foot)
PHYSICAL-HAZARD MATERIALS				
Combustible dust		Note b	Not Applicable	Not Applicable
Combustible fiber	Loose Baled	Note b Notes b, c	Not Applicable	Not Applicable
Combustible liquid	II IIIA IIIB	Not Applicable	0.01 0.02 Not Limited	Not Applicable
Combination Class	I, II and IIIA		0.04	
Cryogenic gas	Flammable Oxidizing	Not Applicable	Not Applicable	Note d 1.25
Explosives		Note b	Note b	Note b
Flammable gas	Gaseous Liquefied	Not Applicable	Not Applicable	Note d Note d
Flammable liquid	IA IB IC	Not Applicable	0.0025 0.025 0.025	Not Applicable
Combination Class	IA, IB and IC		0.025	
Combination Class	I, II and IIIA		0.04	
Flammable solid			0.001	
Organic peroxide	Unclassified detonable	Note b	Not Applicable	Not Applicable
	Class I	Note b		
	Class II	0.025		
	Class III	0.1		
	Class IV	Not Limited		
	Class V	Not Limited		
Oxidizing gas	Gaseous Liquefied	Not Applicable	Not Applicable	1.25 1.25
Combination of gaseous and liquefied				1.25
Oxidizer	Class 4	Note b	Note b	Not Applicable
	Class 3	0.003	0.03	
	Class 2	0.003	0.03	
	Class 1	0.003	0.03	
	Combination Class	1, 2, 3	0.003	
Pyrophoric materials		0.01	0.00125	Notes d and e
Unstable (reactive)	Class 4	Note b	Note b	Note b
	Class 3	0.025	0.0025	Note b
	Class 2	0.1	0.01	Note b
	Class 1	Not Limited	Not Limited	Not Limited
Water reactive	Class 3	Note b	0.00125	Not Applicable
	Class 2	0.25	0.025	
	Class 1	Not Limited	Not Limited	
HEALTH-HAZARD MATERIALS				
Corrosives		Not Limited	Not Limited	Not Limited
Highly toxic		Not Limited	Not Limited	Note d
Toxics		Not Limited	Not Limited	Note d

For SI: 1 pound per square foot = 4.882 kg/m<sup>2</sup>, 1 gallon per square foot = 40.7 L/m<sup>2</sup>, 1 cubic foot @ NTP/square foot = 0.305 m<sup>3</sup> @ NTP/m<sup>2</sup>, 1 cubic foot = 0.02832 m<sup>3</sup>.

- Hazardous materials within piping shall not be included in the calculated quantities.
- Quantity of hazardous materials in a single fabrication shall not exceed the maximum allowable quantities per control area in Tables 307.1(1) and 307.1(2).
- Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
- The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed 9,000 cubic feet at NTP.
- The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 415.5.2.

**[F] 415.10.1.6 Ventilation.** Mechanical exhaust ventilation at the rate of not less than 1 cubic foot per minute per square foot [ $0.0051 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ] of floor area shall be provided throughout the portions of the fabrication area where HPM are used or stored. The exhaust air duct system of one fabrication area shall not connect to another duct system outside that fabrication area within the building.

A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.

Two or more operations at a workstation shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, explosion or hazardous chemical reaction within the exhaust duct system.

Exhaust ducts penetrating fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711 shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls.

Fire dampers shall not be installed in exhaust ducts.

**[F] 415.10.1.7 Transporting hazardous production materials to fabrication areas.** HPM shall be transported to fabrication areas through enclosed piping or tubing systems that comply with Section 415.10.6, through service corridors complying with Section 415.10.3, or in corridors as permitted in the exception to Section 415.10.2. The handling or transporting of HPM within service corridors shall comply with the *California Fire Code*.

**[F] 415.10.1.8 Electrical.** Electrical equipment and devices within the fabrication area shall comply with NFPA 70. The requirements for hazardous locations need not be applied where the average air change is at least four times that set forth in Section 415.10.1.6 and where the number of air changes at any location is not less than three times that required by Section 415.10.1.6. The use of recirculated air shall be permitted.

**[F] 415.10.1.8.1 Workstations.** Workstations shall not be energized without adequate exhaust ventilation. See Section 415.10.1.6 for workstation exhaust ventilation requirements.

**[F] 415.10.2 Corridors.** Corridors shall comply with Chapter 10 and shall be separated from fabrication areas as specified in section 415.10.1.2. Corridors shall not contain HPM and shall not be used for transporting such materials except through closed piping systems as provided in Section 415.10.6.4

**Exception:** Where existing fabrication areas are altered or modified, HPM is allowed to be transported in existing corridors, subject to the following conditions:

1. Nonproduction HPM is allowed to be transported in corridors if utilized for maintenance, lab work and testing.

2. Where existing fabrication areas are altered or modified, HPM is allowed to be transported in existing corridors, subject to the following conditions:

- 2.1. Corridors. Corridors adjacent to the fabrication area where the alteration work is to be done shall comply with Section 1018 for a length determined as follows:

- 2.1.1. The length of the common wall of the corridor and the fabrication area; and

- 2.1.2. For the distance along the corridor to the point of entry of HPM into the corridor serving that fabrication area.

- 2.2. Emergency alarm system. There shall be an emergency telephone system, a local manual alarm station or other approved alarm-initiating device within corridors at not more than 150-foot (45 720 mm) intervals and at each exit and doorway. The signal shall be relayed to an approved central, proprietary or remote station service or the emergency control station and shall also initiate a local audible alarm.

- 2.3. Pass-throughs. Self-closing doors having a fire protection rating of not less than 1 hour shall separate pass-throughs from existing corridors. Pass-throughs shall be constructed as required for the corridors and protected by an approved automatic sprinkler system.

**[F] 415.10.3 Service corridors.** Service corridors within a Group H-5 occupancy shall comply with Sections 415.10.3.1 through 415.10.3.4.

**[F] 415.10.3.1 Use conditions.** Service corridors shall be separated from corridors as required by Section 415.10.1.2. Service corridors shall not be used as a required corridor.

**[F] 415.10.3.2 Mechanical ventilation.** Service corridors shall be mechanically ventilated as required by Section 415.10.1.6 or at not less than six air changes per hour, whichever is greater.

**[F] 415.10.3.3 Means of egress.** The distance of travel from any point in a service corridor to an exit, exit access corridor or door into a fabrication area shall be not greater than 75 feet (22 860 mm). Dead ends shall be not greater than 4 feet (1219 mm) in length. There shall be not less than two exits, and not more than one-half of the required means of egress shall require travel into a fabrication area. Doors from service corridors shall swing in the direction of egress travel and shall be self-closing.

**[F] 415.10.3.4 Minimum width.** The clear width of a service corridor shall be not less than 5 feet (1524 mm),

or 33 inches (838 mm) wider than the widest cart or truck used in the service corridor, whichever is greater.

**[F] 415.10.3.5 Emergency alarm system.** Emergency alarm systems shall be provided in accordance with this section and Sections 414.7.1 and 414.7.2. The maximum allowable quantity per control area provisions shall not apply to emergency alarm systems required for HPM.

**[F] 415.10.3.5.1 Service corridors.** An emergency alarm system shall be provided in service corridors, with no fewer than one alarm device in each service corridor.

**[F] 415.10.3.5.2 Corridors and interior exit stairways and ramps.** Emergency alarms for corridors, interior exit stairways and ramps and exit passageways shall comply with Section 414.7.2.

**[F] 415.10.3.5.3 Liquid storage rooms, HPM rooms and gas rooms.** Emergency alarms for liquid storage rooms, HPM rooms and gas rooms shall comply with Section 414.7.1.

**[F] 415.10.3.5.4 Alarm-initiating devices.** An approved emergency telephone system, local alarm manual pull stations, or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

**[F] 415.10.3.5.5 Alarm signals.** Activation of the emergency alarm system shall sound a local alarm and transmit a signal to the emergency control station.

**[F] 415.10.4 Storage of hazardous production materials.** Storage of hazardous production materials (HPM) in fabrication areas shall be within approved or listed storage cabinets or gas cabinets or within a workstation. The storage of HPM in quantities greater than those listed in Section 5004.2 of the *California Fire Code* shall be in liquid storage rooms, HPM rooms or gas rooms as appropriate for the materials stored. The storage of other hazardous materials shall be in accordance with other applicable provisions of this code and the *California Fire Code*.

**[F] 415.10.5 HPM rooms, gas rooms, liquid storage room construction.** HPM rooms, gas rooms and liquid shall be constructed in accordance with Sections 415.10.5.1 through 415.10.5.9.

**[F] 415.10.5.1 HPM rooms and gas rooms.** HPM rooms and gas rooms shall be separated from other areas by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than 2 hours where the area is 300 square feet (27.9 m<sup>2</sup>) or more and not less than 1 hour where the area is less than 300 square feet (27.9 m<sup>2</sup>).

**[F] 415.10.5.2 Liquid storage rooms.** Liquid storage rooms shall be constructed in accordance with the following requirements:

1. Rooms greater than 500 square feet (46.5 m<sup>2</sup>) in area, shall have no fewer than one exterior door approved for fire department access.
2. Rooms shall be separated from other areas by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than 1 hour for rooms up to 150 square feet (13.9 m<sup>2</sup>) in area and not less than 2 hours where the room is more than 150 square feet (13.9 m<sup>2</sup>) in area.
3. Shelving, racks and wainscoting in such areas shall be of noncombustible construction or wood of not less than 1-inch (25 mm) nominal thickness or fire-retardant-treated wood complying with Section 2303.2.
4. Rooms used for the storage of Class I flammable liquids shall not be located in a basement.

**[F] 415.10.5.3 Floors.** Except for surfacing, floors of HPM rooms and liquid storage rooms shall be of noncombustible liquid-tight construction. Raised grating over floors shall be of noncombustible materials.

**[F] 415.10.5.4 Location.** Where HPM rooms, liquid storage rooms and gas rooms are provided, they shall have no fewer than one exterior wall and such wall shall be not less than 30 feet (9144 mm) from lot lines, including lot lines adjacent to public ways.

**[F] 415.10.5.5 Explosion control.** Explosion control shall be provided where required by Section 414.5.1.

**[F] 415.10.5.6 Exits.** Where two exits are required from HPM rooms, liquid storage rooms and gas rooms, one shall be directly to the outside of the building.

**[F] 415.10.5.7 Doors.** Doors in a fire barrier wall, including doors to corridors, shall be self-closing fire door assemblies having a fire protection rating of not less than <sup>3</sup>/<sub>4</sub> hour.

**[F] 415.10.5.8 Ventilation.** Mechanical exhaust ventilation shall be provided in liquid storage rooms, HPM rooms and gas rooms at the rate of not less than 1 cubic foot per minute per square foot (0.044 L/s/m<sup>2</sup>) of floor area or six air changes per hour, whichever is greater, for categories of material.

Exhaust ventilation for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding areas and direct the exhaust ventilation to an exhaust system.

**[F] 415.10.5.9 Emergency alarm system.** An approved emergency alarm system shall be provided for HPM rooms, liquid storage rooms and gas rooms.

Emergency alarm-initiating devices shall be installed outside of each interior exit door of such rooms.

Activation of an emergency alarm-initiating device shall sound a local alarm and transmit a signal to the emergency control station.

An approved emergency telephone system, local alarm manual pull stations or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

**[F] 415.10.6 Piping and tubing.** Hazardous production materials piping and tubing shall comply with this section and ASME B31.3.

**[F] 415.10.6.1 HPM having a health-hazard ranking of 3 or 4.** Systems supplying HPM liquids or gases having a health-hazard ranking of 3 or 4 shall be welded throughout, except for connections, to the systems that are within a ventilated enclosure if the material is a gas, or an approved method of drainage or containment is provided for the connections if the material is a liquid.

**[F] 415.10.6.2 Location in service corridors.** Hazardous production materials supply piping or tubing in service corridors shall be exposed to view.

**[F] 415.10.6.3 Excess flow control.** Where HPM gases or liquids are carried in pressurized piping above 15 pounds per square inch gauge (psig) (103.4 kPa), excess flow control shall be provided. Where the piping originates from within a liquid storage room, HPM room or gas room, the excess flow control shall be located within the liquid storage room, HPM room or gas room. Where the piping originates from a bulk source, the excess flow control shall be located as close to the bulk source as practical.

**[F] 415.10.6.4 Installations in corridors and above other occupancies.** The installation of HPM piping and tubing within the space defined by the walls of corridors and the floor or roof above, or in concealed spaces above other occupancies, shall be in accordance with Sections 415.10.6.1 through 415.10.6.3 and the following conditions:

1. Automatic sprinklers shall be installed within the space unless the space is less than 6 inches (152 mm) in the least dimension.
2. Ventilation not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.
3. Where the piping or tubing is used to transport HPM liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect any discharge or leakage and drain it to an approved location. The 1-hour enclosure shall not be used as part of the receptor.
4. HPM supply piping and tubing and nonmetallic waste lines shall be separated from the corridor and from occupancies other than Group H-5 by

fire barriers that have a fire-resistance rating of not less than 1 hour. Where gypsum wallboard is used, joints on the piping side of the enclosure are not required to be taped, provided the joints occur over framing members. Access openings into the enclosure shall be protected by approved fire protection-rated assemblies.

5. Readily accessible manual or automatic remotely activated fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:

5.1. At branch connections into the fabrication area.

5.2. At entries into corridors.

**Exception:** Transverse crossings of the corridors by supply piping that is enclosed within a ferrous pipe or tube for the width of the corridor need not comply with Items 1 through 5.

**[F] 415.10.6.5 Identification.** Piping, tubing and HPM waste lines shall be identified in accordance with ANSI A13.1 to indicate the material being transported.

**[F] 415.10.7 Continuous gas detection systems.** A continuous gas detection system shall be provided for HPM gases where the physiological warning threshold level of the gas is at a higher level than the accepted permissible exposure limit (PEL) for the gas and for flammable gases in accordance with Sections 415.10.7.1 and 415.10.7.2.

**[F] 415.10.7.1 Where required.** A continuous gas detection system shall be provided in the areas identified in Sections 415.10.7.1.1 through 415.10.7.1.4.

**[F] 415.10.7.1.1 Fabrication areas.** A continuous gas detection system shall be provided in fabrication areas where gas is used in the fabrication area.

**[F] 415.10.7.1.2 HPM rooms.** A continuous gas detection system shall be provided in HPM rooms where gas is used in the room.

**[F] 415.10.7.1.3 Gas cabinets, exhausted enclosures and gas rooms.** A continuous gas detection system shall be provided in gas cabinets and exhausted enclosures. A continuous gas detection system shall be provided in gas rooms where gases are not located in gas cabinets or exhausted enclosures.

**[F] 415.10.7.1.4 Corridors.** Where gases are transported in piping placed within the space defined by the walls of a corridor and the floor or roof above the corridor, a continuous gas detection system shall be provided where piping is located and in the corridor.

**Exception:** A continuous gas detection system is not required for occasional transverse crossings of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

**[F] 415.10.7.2 Gas detection system operation.** The continuous gas detection system shall be capable of

monitoring the room, area or equipment in which the gas is located at or below all the following gas concentrations:

1. Immediately dangerous to life and health (IDLH) values where the monitoring point is within an exhausted enclosure, ventilated enclosure or gas cabinet.
2. Permissible exposure limit (PEL) levels where the monitoring point is in an area outside an exhausted enclosure, ventilated enclosure or gas cabinet.
3. For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 25 percent of the lower flammable limit (LFL) where the monitoring is within or outside an exhausted enclosure, ventilated enclosure or gas cabinet.
4. Except as noted in this section, monitoring for highly toxic and toxic gases shall also comply with Chapter 60 of the *California Fire Code*.

**[F] 415.10.7.2.1 Alarms.** The gas detection system shall initiate a local alarm and transmit a signal to the emergency control station when a short-term hazard condition is detected. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where the gas is detected. The audible alarm shall be distinct from all other alarms.

**[F] 415.10.7.2.2 Shutoff of gas supply.** The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or an exhausted enclosure, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

**Exception:** Where the gas detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribu-

tion manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

**[F] 415.10.8 Manual fire alarm system.** An approved manual fire alarm system shall be provided throughout buildings containing Group H-5. Activation of the alarm system shall initiate a local alarm and transmit a signal to the emergency control station. The fire alarm system shall be designed and installed in accordance with Section 907.

**[F] 415.10.9 Emergency control station.** An emergency control station shall be provided in accordance with Sections 415.10.9.1 through 415.10.9.3.

**[F] 415.10.9.1 Location.** The emergency control station shall be located on the premises at an approved location outside the fabrication area.

**[F] 415.10.9.2 Staffing.** Trained personnel shall continuously staff the emergency control station.

**[F] 415.10.9.3 Signals.** The emergency control station shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not be limited to, the following where such equipment or systems are required to be provided either in this chapter or elsewhere in this code:

1. Automatic sprinkler system alarm and monitoring systems.
2. Manual fire alarm systems.
3. Emergency alarm systems.
4. Continuous gas detection systems.
5. Smoke detection systems.
6. Emergency power system.
7. Automatic detection and alarm systems for pyrophoric liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *California Fire Code*.
8. Exhaust ventilation flow alarm devices for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in Section 2705.2.3.4 of the *California Fire Code*.

**[F] 415.10.10 Emergency power system.** An emergency power system shall be provided in Group H-5 occupancies where required in Section 415.10.10.1. The emergency power system shall be designed to supply power automatically to required electrical systems when the normal electrical supply system is interrupted.

**[F] 415.10.10.1 Required electrical systems.** Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust ventilation systems.
2. HPM gas cabinet ventilation systems.
3. HPM exhausted enclosure ventilation systems.
4. HPM gas room ventilation systems.

5. HPM gas detection systems.
6. Emergency alarm systems.
7. Manual fire alarm systems.
8. Automatic sprinkler system monitoring and alarm systems.
9. Automatic alarm and detection systems for pyrophoric liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *California Fire Code*.
10. Flow alarm switches for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in Section 2705.2.3.4 of the *California Fire Code*.
11. Electrically operated systems required elsewhere in this code or in the *California Fire Code* applicable to the use, storage or handling of HPM.

**[F] 415.10.10.2 Exhaust ventilation systems.** Exhaust ventilation systems are allowed to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

**[F] 415.10.11 Automatic sprinkler system protection in exhaust ducts for HPM.** An approved automatic sprinkler system shall be provided in exhaust ducts conveying gases, vapors, fumes, mists or dusts generated from HPM in accordance with Sections 415.10.11.1 through 415.10.11.3 and the *California Mechanical Code*.

**[F] 415.10.11.1 Metallic and noncombustible non-metallic exhaust ducts.** An approved automatic sprinkler system shall be provided in metallic and noncombustible nonmetallic exhaust ducts where all of the following conditions apply:

1. Where the largest cross-sectional diameter is equal to or greater than 10 inches (254 mm).
2. The ducts are within the building.
3. The ducts are conveying flammable gases, vapors or fumes.

**[F] 415.10.11.2 Combustible nonmetallic exhaust ducts.** Automatic sprinkler system protection shall be provided in combustible nonmetallic exhaust ducts where the largest cross-sectional diameter of the duct is equal to or greater than 10 inches (254 mm).

**Exception:** Duct need not be provided with automatic sprinkler protection as follows:

1. Ducts listed or approved for applications without automatic sprinkler system protection.
2. Ducts not more than 12 feet (3658 mm) in length installed below ceiling level.

**[F] 415.10.11.3 Automatic sprinkler locations.** Sprinkler systems shall be installed at 12-foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical ducts, sprinklers shall be installed at the top and at alternate floor levels.

#### **415.11 Group H occupancies located above the 10th story.**

**415.11.1 Fire – smoke barrier.** Any story containing a Group H occupancy above the 10th story shall be subdivided by a fire-smoke barrier constructed as a fire barrier having a fire resistance rating of not less than 2 hours and shall also comply with the smoke barrier requirements of Section 710. The 2-hour fire-smoke barrier shall be in accordance with Sections 415.11.1.1 through 415.11.1.5.

**415.11.1.1** The 2-hour fire-smoke barrier shall be continuous from exterior wall to exterior wall.

**415.11.1.2** The fire-smoke barrier shall divide the story so that the square footage on each side of the 2-hour fire-smoke barrier is not less than 30 percent of the total floor area.

**415.11.1.3** A minimum of one door opening shall be provided in the 2-hour fire-smoke barrier for emergency access.

**415.11.1.4** Each side of the 2-hour fire-smoke barrier shall be designed as a separate smoke zone designed in accordance with Section 909.6.

**415.11.1.5** The area on each side of the 2-hour fire-smoke barrier shall be served by a minimum of one exit enclosure in accordance with Section 1022.

**415.12 Elevators and elevator lobbies above the 10th story.** Any story containing a Group H occupancy above the 10th story shall be provided with elevators and elevator lobbies in accordance with Sections 415.12.1 through 415.12.3.

**415.12.1** An elevator that serves every story of the building shall be provided on each side of the 2-hour fire-smoke barrier.

**415.12.2** An elevator lobby shall be provided on each side of the 2-hour fire-smoke barrier at each floor in accordance with Section 708.14.1. Exceptions to 708.14.1 shall not apply.

**415.12.3** The elevator and its associated elevator lobbies and elevator machine rooms shall be pressurized in accordance with Section 909.6.

## **SECTION 416 APPLICATION OF FLAMMABLE FINISHES**

**[F] 416.1 General.** The provisions of this section shall apply to the construction, installation and use of buildings and structures, or parts thereof, for the application of flammable finishes. Such construction and equipment shall comply with the *California Fire Code*.

**[F] 416.2 Spray rooms.** Spray rooms shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Floors shall be water-proofed and drained in an approved manner.

**[F] 416.2.1 Surfaces.** The interior surfaces of spray rooms shall be smooth and shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning, and shall be so



designed to confine residues within the room. Aluminum shall not be used.

**[F] 416.2.2 Ventilation.** Mechanical ventilation and interlocks with the spraying operation shall be in accordance with the *California Mechanical Code*.

**[F] 416.3 Spraying spaces.** Spraying spaces shall be ventilated with an exhaust system to prevent the accumulation of flammable mist or vapors in accordance with the *California Mechanical Code*. Where such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of flammable vapors.

**[F] 416.3.1 Surfaces.** The interior surfaces of spraying spaces shall be smooth and continuous without edges; shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning; and shall be so designed to confine residues within the spraying space. Aluminum shall not be used.

**[F] 416.4 Spray booths.** Spray booths shall be designed, constructed and operated in accordance with the *California Fire Code*.

**[F] 416.5 Fire protection.** An automatic sprinkler system or fire-extinguishing system shall be provided in all spray, dip and immersing spaces and storage rooms and shall be installed in accordance with Chapter 9.

## SECTION 417 DRYING ROOMS

**[F] 417.1 General.** A drying room or dry kiln installed within a building shall be constructed entirely of approved noncombustible materials or assemblies of such materials regulated by the approved rules or as required in the general and specific sections of this chapter for special occupancies and where applicable to the general requirements of the *California Mechanical Code*.

**[F] 417.2 Piping clearance.** Overhead heating pipes shall have a clearance of not less than 2 inches (51 mm) from combustible contents in the dryer.

**[F] 417.3 Insulation.** Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of airspace, or the metal walls shall be lined with 1/4-inch (6.35 mm) insulating mill board or other approved equivalent insulation.

**[F] 417.4 Fire protection.** Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in Chapter 4, shall be protected by an approved automatic fire-extinguishing system complying with the provisions of Chapter 9.

## SECTION 418 ORGANIC COATINGS

**[F] 418.1 Building features.** Manufacturing of organic coatings shall be done only in buildings that do not have pits or basements.

**[F] 418.2 Location.** Organic coating manufacturing operations and operations incidental to or connected therewith shall not be located in buildings having other occupancies.

**[F] 418.3 Process mills.** Mills operating with close clearances and that process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a detached building or noncombustible structure.

**[F] 418.4 Tank storage.** Storage areas for flammable and combustible liquid tanks inside of structures shall be located at or above grade and shall be separated from the processing area by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**[F] 418.5 Nitrocellulose storage.** Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed with not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**[F] 418.6 Finished products.** Storage rooms for finished products that are flammable or combustible liquids shall be separated from the processing area by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

## SECTION 419 LIVE/WORK UNITS

**419.1 General.** A live/work unit shall comply with Sections 419.1 through 419.9.

**Exception:** Dwelling or sleeping units that include an office that is less than 10 percent of the area of the dwelling unit are permitted to be classified as dwelling units with accessory occupancies in accordance with Section 508.2.

**419.1.1 Limitations.** The following shall apply to all live/work areas:

1. The live/work unit is permitted to be not greater than 3,000 square feet (279 m<sup>2</sup>) in area;
2. The nonresidential area is permitted to be not more than 50 percent of the area of each live/work unit;
3. The nonresidential area function shall be limited to the first or main floor only of the live/work unit; and
4. Not more than five nonresidential workers or employees are allowed to occupy the nonresidential area at any one time.

**419.2 Occupancies.** Live/work units shall be classified as a Group R-2 occupancy. Separation requirements found in Sections 420 and 508 shall not apply within the live/work unit where the live/work unit is in compliance with Section 419. Nonresidential uses which would otherwise be classified as either a Group H or S occupancy shall not be permitted in a live/work unit.

**Exception:** Storage shall be permitted in the live/work unit provided the aggregate area of storage in the nonresi-

dential portion of the live/work unit shall be limited to 10 percent of the space dedicated to nonresidential activities.

**419.3 Means of egress.** Except as modified by this section, the means of egress components for a live/work unit shall be designed in accordance with Chapter 10 for the function served.

**419.3.1 Egress capacity.** The egress capacity for each element of the live/work unit shall be based on the occupant load for the function served in accordance with Table 1004.1.1.

**419.3.2 Spiral stairways.** Spiral stairways that conform to the requirements of Section 1009.12 shall be permitted.

**419.4 Vertical openings.** Floor openings between floor levels of a live/work unit are permitted without enclosure.

**[F] 419.5 Fire protection.** The live/work unit shall be provided with a monitored fire alarm system where required by Section 907.2.9 and an automatic sprinkler system in accordance with Section 903.2.8.

**419.6 Structural.** Floor loading for the areas within a live/work unit shall be designed to conform to Table 1607.1 based on the function within the space.

**419.7 Accessibility.** Accessibility shall be designed in accordance with Chapter 11A and/or 11B, when applicable for the function served.

**419.8 Ventilation.** The applicable ventilation requirements of the *California Mechanical Code* shall apply to each area within the live/work unit for the function within that space.

**419.9 Plumbing facilities.** The nonresidential area of the live/work unit shall be provided with minimum plumbing facilities as specified by the *California Plumbing Code*, based on the function of the nonresidential area. Where the nonresidential area of the live/work unit is required to be accessible, the plumbing fixtures specified by the *California Plumbing Code* shall be accessible.

## SECTION 420

### GROUPS R-1, R-2, R-2.1, R-3, R3.1 and R-4

**420.1 General.** Occupancies in Groups R-1, R-2, R-2.1, R-3, R3.1 and R-4 shall comply with the provisions of Sections 420.1 through 420.5 and other applicable provisions of this code.

**420.2 Separation walls.** Walls separating dwelling units in the same building, walls separating sleeping units in the same building and walls separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as fire partitions in accordance with Section 708.

**420.3 Horizontal separation.** Floor assemblies separating dwelling units in the same buildings, floor assemblies separating sleeping units in the same building and floor assemblies separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as horizontal assemblies in accordance with Section 711.

**[F] 420.4 Automatic sprinkler system.** Group R occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.8. Group I-1 occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.6. Quick-response or residential automatic sprinklers shall be installed in accordance with Section 903.3.2.

**[F] 420.5 Smoke detection and fire alarm systems.** Fire alarm systems and smoke alarms shall be provided in Group I-1, R-1 and R-2 occupancies in accordance with Sections 907.2.6, 907.2.8 and 907.2.9, respectively. Single- or multiple-station smoke alarms shall be in accordance with Section 907.2.11.

### 420.6 Carbon monoxide alarms. (HCD 1, HCD 2 & HCD 1-AC)

**420.6.1 Carbon monoxide alarms in new construction.** Newly constructed Group R occupancies located in a building containing a fuel-burning appliance or a building that has an attached garage shall be equipped with single station carbon monoxide alarms. The carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed and maintained in accordance with NFPA 720 and the manufacturer's instructions. An open parking garage, as defined in the *California Building Code*, or an enclosed parking garage ventilated in accordance with the *California Mechanical Code* shall not be deemed to be an attached garage.

**Exception:** Sleeping units or dwelling units that do not themselves contain a fuel-burning appliance or have an attached garage, but that are located in a building with a fuel-burning appliance or an attached garage, need not be provided with single station carbon monoxide alarms provided that:

1. The sleeping unit or dwelling unit is located more than one story above or below any story that contains a fuel-burning appliance or an attached garage; and
2. The sleeping unit or dwelling unit is not connected by duct work or ventilation shafts to any room containing a fuel-burning appliance or to an attached garage; and
3. The building is equipped with a common area carbon monoxide detection system that includes all enclosed common area spaces.

**420.6.1.1 Carbon monoxide detection systems.** Carbon monoxide detection systems that include carbon monoxide detectors and audible notification appliances installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720 shall be permitted. The carbon monoxide detectors shall be listed as complying with UL 2075.

**420.6.1.2 Power supply.** Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery back-up. Alarm wiring shall be directly connected to the perma-

nent building wiring without a disconnecting switch other than as required for overcurrent protection.

**Exceptions:**

1. Where there is no commercial power supply, the carbon monoxide alarm may be solely battery operated.
2. Other power sources recognized for use by NFPA 720.

**420.6.1.3 Interconnection.** Where more than one carbon monoxide alarm is required to be installed within the dwelling unit or within a sleeping unit, the alarm shall be interconnected in a manner that activation of one alarm shall activate all of the alarms in the individual unit.

**420.6.1.4 Alarm requirements.** No person shall install, market, distribute, offer for sale, or sell any carbon monoxide device in the State of California unless the device and instructions have been approved and listed by the State Fire Marshal.

Carbon monoxide alarms required by Section 420.6.1 shall be installed and maintained in the following locations:

1. Outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedroom(s).
2. On every level of a dwelling unit including basements.
3. Group R-1 Occupancies only.
  - a. On the ceiling of every sleeping unit or other locations within the sleeping unit in compliance with the manufacturer's installation instructions.

**420.6.1.5 Multiple-purpose alarms.** Carbon monoxide alarms combined with smoke alarms shall comply with Section 420.6, all applicable standards, and requirements for listing and approval by the Office of the State Fire Marshal, for smoke alarms.

**420.6.1.6 Visible alarms.** In buildings containing covered multifamily dwellings as defined in Chapter 11A, with fuel-burning appliances and/or attached garages as described in Section 420.6.1, all required carbon monoxide alarms shall be equipped with the capability to support visible alarm notification in accordance with NFPA 720.

**420.6.2 Carbon monoxide alarms in existing dwellings or sleeping units.** Existing Group R occupancies located in a building with a fossil fuel-burning heater or appliance, fireplace or an attached garage shall have single station carbon monoxide alarms installed in accordance with this section. The carbon monoxide alarms shall be listed as complying with UL 2034 and be installed and maintained in accordance with NFPA 720 and the manufacturer's instructions.

An open parking garage, as defined in the California Building Code, or an enclosed parking garage ventilated

in accordance with the California Mechanical Code shall not be deemed to be an attached garage.

**Exception:** Sleeping units or dwelling units that do not themselves contain a fossil fuel-burning heater or appliance, fireplace or an attached garage, but that are located in a building with a fossil fuel-burning appliance or an attached garage, need not be provided with single station carbon monoxide alarms provided that:

1. The sleeping unit or dwelling unit is located more than one story above or below any story that contains a fuel-burning appliance or an attached garage; and
2. The sleeping unit or dwelling unit is not connected by duct work or ventilation shafts to any room containing a fuel-burning appliance or to an attached garage; and
3. The building is equipped with a common area carbon monoxide detection system, carbon monoxide detector or combination detector in the same space as permanently installed fuel-burning appliance(s).

**420.6.2.1 Carbon monoxide detection systems.** Carbon monoxide detection systems that include carbon monoxide detectors and audible notification appliances, installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720 shall be permitted. The carbon monoxide detectors shall be listed as complying with UL 2075.

**420.6.2.2 Existing dwellings or sleeping units requiring a permit.** When a permit is required for alterations, repairs or additions with a total cost or calculated valuation exceeding one thousand dollars (\$1,000), existing dwellings or sleeping units with a fossil fuel-burning heater or appliance, fireplace or an attached garage shall have a carbon monoxide alarm installed in accordance with Section 420.6.2. Carbon monoxide alarms shall only be required in the specific dwelling unit or sleeping unit for which the permit was obtained.

**420.6.2.3 Existing dwellings or sleeping units not requiring a permit (no construction taking place).** Pursuant to Health and Safety Code Section 17926, a carbon monoxide alarm(s) shall be installed in every existing dwelling unit or sleeping unit with a fossil fuel-burning heater or appliance, fireplace or an attached garage as follows:

**420.6.2.3.1 Carbon monoxide alarms on or after July 1, 2011.** Carbon monoxide alarms shall be installed in accordance with Section 420.6.2 in existing detached single-family dwellings or sleeping units intended for human occupancy that have a fossil fuel-burning heater or appliance, fireplace or an attached garage. Carbon monoxide alarms in existing buildings are permitted to be solely battery operated or plug-in type with battery back-up in areas where no construction is taking place.

**420.6.2.3.2 Carbon monoxide alarms on or after January 1, 2013.** Carbon monoxide alarms shall be

installed in accordance with Section 420.6.2 in all other existing dwelling units intended for human occupancy as defined in Health and Safety Code Section 13262(b) that have a fossil fuel-burning heater or appliance, fireplace or an attached garage. Carbon monoxide alarms in existing buildings are permitted to be solely battery operated or plug-in type with battery back-up in areas where no construction is taking place.

**420.6.2.4 Power supply.** Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with battery back-up. Alarm wiring shall be directly connected to the permanent building wiring without a disconnecting switch other than as required for overcurrent protection.

**Exceptions:**

1. In existing dwelling units where there is no commercial power supply, the carbon monoxide alarm may be solely battery operated.
2. In existing dwelling units, a carbon monoxide alarm is permitted to be solely battery operated or plug-in with a battery backup where repairs or alterations do not result in the removal of wall and ceiling finishes.
3. In existing dwelling units, a carbon monoxide alarm is permitted to be solely battery operated or plug-in with battery backup where repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.
4. In existing dwelling units, a carbon monoxide alarm is permitted to be solely battery operated or plug-in with battery backup when work is limited to the installation, alteration or repair of plumbing or mechanical systems or the installation, alteration or repair of electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure.
5. Other power sources recognized for use by NFPA 720.

**420.6.2.5 Interconnection.** Where more than one carbon monoxide alarm is required to be installed within the dwelling unit or within a sleeping unit, the alarm shall be interconnected in a manner that activation of one alarm shall activate all of the alarms in the individual unit.

**Exceptions:**

1. In existing dwelling units or within sleeping units, interconnection is not required where repairs do not result in the removal of wall

and ceiling finishes and no previous method for interconnection existed.

2. In existing dwelling units, carbon monoxide alarms are not required to be interconnected where no construction is taking place.
3. In existing dwelling units, carbon monoxide alarms are not required to be interconnected where repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.
4. In existing dwelling units, carbon monoxide alarms are not required to be interconnected when work is limited to the installation, alteration or repair of plumbing or mechanical systems or the installation, alteration or repair of electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure.

**420.6.2.6 Alarm requirements.** No person shall install, market, distribute, offer for sale, or sell any carbon monoxide device in the State of California unless the device and instructions have been approved and listed by the State Fire Marshal.

Carbon monoxide alarms required by Section 420.6.2 shall be installed and maintained in the following locations:

1. Outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedroom(s).
2. On every level of a dwelling unit including basements.
3. Group R-1 Occupancies only.
  - a. On the ceiling of every sleeping unit or other locations within the sleeping unit in compliance with the manufacturer's installation instructions.

**420.7 (HCD 1) Construction waste management.** Recycle and/or salvage for reuse a minimum of 50 percent of the non-hazardous construction and demolition waste in accordance with the California Green Building Standards Code (CAL-Green), Chapter 4, Division 4.4.

**420.8 Special provisions for residential hotels. (HCD 1 & HCD 1-AC)**

**420.8.1 Locking mail receptacles.** A locking mail receptacle for each residential unit shall be provided in all residential hotels pursuant to the requirements specified in Health and Safety Code Section 17958.3.

**420.9 Licensed 24-hour care facilities in a Group R-2.1, R-3.1 or R-4 occupancy.** See Section 425 for Special Provisions for licensed 24-hour care facilities in a Group R-2.1, R-3.1, or R-4 occupancy.

**420.10 Existing Group R Occupancies.** See Chapter 34.

## SECTION 421 HYDROGEN CUTOFF ROOMS

**[F] 421.1 General.** Where required by the *California Fire Code*, hydrogen cutoff rooms shall be designed and constructed in accordance with Sections 421.1 through 421.8.

**[F] 421.2 Definitions.** The following terms are defined in Chapter 2:

### GASEOUS HYDROGEN SYSTEM.

#### HYDROGEN CUTOFF ROOM.

**[F] 421.3 Location.** Hydrogen cutoff rooms shall not be located below grade.

**[F] 421.4 Design and construction.** Hydrogen cutoff rooms shall be classified with respect to occupancy in accordance with Section 302.1 and separated from other areas of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both; or as required by Section 508.2, 508.3 or 508.4, as applicable.

**[F] 421.4.1 Opening protectives.** Doors within the fire barriers, including doors to corridors, shall be self-closing in accordance with Section 716. Interior door openings shall be electronically interlocked to prevent operation of the hydrogen system when doors are opened or ajar or the room shall be provided with a mechanical exhaust ventilation system designed in accordance with Section 421.4.1.1.

**[F] 421.4.1.1 Ventilation alternative.** Where an exhaust system is used in lieu of the interlock system required by Section 421.4.1, exhaust ventilation systems shall operate continuously and shall be designed to operate at a negative pressure in relation to the surrounding area. The average velocity of ventilation at the face of the door opening with the door in the fully open position shall not be less than 60 feet per minute (0.3048 m/s) and not less than 45 feet per minute (0.2287 m/s) at any point in the door opening.

**[F] 421.4.2 Windows.** Operable windows in interior walls shall not be permitted. Fixed windows shall be permitted where in accordance with Section 716.

**[F] 421.5 Ventilation.** Cutoff rooms shall be provided with mechanical ventilation in accordance with the applicable provisions for repair garages in Chapter 5 of the *California Mechanical Code*.

**[F] 421.6 Gas detection system.** Hydrogen cutoff rooms shall be provided with an approved flammable gas detection system in accordance with Sections 421.6.1 through 421.6.3.

**[F] 421.6.1 System design.** The flammable gas detection system shall be listed for use with hydrogen and any other flammable gases used in the room. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower flammability limit (LFL) for the gas or mixtures present at their anticipated temperature and pressure.

**[F] 421.6.2 Operation.** Activation of the gas detection system shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals both inside and outside of the cutoff room.
2. Activation of the mechanical ventilation system.

**[F] 421.6.3 Failure of the gas detection system.** Failure of the gas detection system shall result in activation of the mechanical ventilation system, cessation of hydrogen generation and the sounding of a trouble signal in an approved location.

**[F] 421.7 Explosion control.** Explosion control shall be provided in accordance with Chapter 9 of the *California Fire Code*.

**[F] 421.8 Standby power.** Mechanical ventilation and gas detection systems shall be connected to a standby power system in accordance with Chapter 27.

## SECTION 422 AMBULATORY CARE FACILITIES

**422.1 General.** Occupancies classified as ambulatory care facilities shall comply with the provisions of Sections 422.1 through 422.7 and other applicable provisions of this code.

**422.2 Separation.** Ambulatory care facilities where the potential for four or more care recipients are to be incapable of self-preservation at any time, whether rendered incapable by staff or staff accepted responsibility for a care recipient already incapable, shall be separated from adjacent spaces, corridors or tenants with a fire partition installed in accordance with Section 708.

**422.3 Smoke compartments.** Where the aggregate area of one or more ambulatory care facilities is greater than 10,000 square feet (929 m<sup>2</sup>) on one story, the story shall be provided with a smoke barrier to subdivide the story into no fewer than two smoke compartments. The area of any one such smoke compartment shall be not greater than 22,500 square feet (2092 m<sup>2</sup>). The travel distance from any point in a smoke compartment to a smoke barrier door shall be not greater than 200 feet (60 960 mm). The smoke barrier shall be installed in accordance with Section 709 with the exception that smoke barriers shall be continuous from outside wall to an outside wall, a floor to a floor, or from a smoke barrier to a smoke barrier or a combination thereof.

**422.4 Refuge area.** Not less than 30 net square feet (2.8 m<sup>2</sup>) for each nonambulatory care recipient shall be provided within the aggregate area of corridors, care recipient rooms, treatment rooms, lounge or dining areas and other low-hazard areas within each smoke compartment. Each occupant of an ambulatory care facility shall be provided with access to a refuge area without passing through or utilizing adjacent tenant spaces.

**422.5 Independent egress.** A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.

**[F] 422.6 Automatic sprinkler systems.** Automatic sprinkler systems shall be provided for ambulatory care facilities in accordance with Section 903.2.2.

**[F] 422.7 Fire alarm systems.** A fire alarm system shall be provided for ambulatory care facilities in accordance with Section 907.2.2.1.

## SECTION 423 STORM SHELTERS

**423.1 General.** In addition to other applicable requirements in this code, storm shelters shall be constructed in accordance with ICC-500.

**423.1.1 Scope.** This section applies to the construction of storm shelters constructed as separate detached buildings or constructed as safe rooms within buildings for the purpose of providing safe refuge from storms that produce high winds, such as tornados and hurricanes. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters.

**423.2 Definitions.** The following terms are defined in Chapter 2:

### STORM SHELTER.

**Community storm shelter.**

**Residential storm shelter.**

## SECTION 424 CHILDREN'S PLAY STRUCTURES

**424.1 Children's play structures.** Children's play structures installed inside all occupancies covered by this code that exceed 10 feet (3048 mm) in height and 150 square feet (14 m<sup>2</sup>) in area shall comply with Sections 424.2 through 424.5.

**424.2 Materials.** Children's play structures shall be constructed of noncombustible materials or of combustible materials that comply with the following:

1. Fire-retardant-treated wood complying with Section 2303.2.
2. Light-transmitting plastics complying with Section 2606.
3. Foam plastics (including the pipe foam used in soft-contained play equipment structures) having a maximum heat-release rate not greater than 100 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289, using the 20 kW ignition source.
4. Aluminum composite material (ACM) meeting the requirements of Class A interior finish in accordance with Chapter 8 when tested as an assembly in the maximum thickness intended for use.
5. Textiles and films complying with the flame propagation performance criteria contained in NFPA 701.
6. Plastic materials used to construct rigid components of soft-contained play equipment structures (such as tubes, windows, panels, junction boxes, pipes, slides and decks) exhibiting a peak rate of heat release not exceeding 400 kW/ m<sup>2</sup> when tested in accordance with

ASTM E 1354 at an incident heat flux of 50 kW/m<sup>2</sup> in the horizontal orientation at a thickness of 6 mm.

7. Ball pool balls, used in soft-contained play equipment structures, having a maximum heat-release rate not greater than 100 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289, using the 20 kW ignition source. The minimum specimen test size shall be 36 inches by 36 inches (914 mm by 914 mm) by an average of 21 inches (533 mm) deep, and the balls shall be held in a box constructed of galvanized steel poultry netting wire mesh.
8. Foam plastics shall be covered by a fabric, coating or film meeting the flame propagation performance criteria of NFPA 701.
9. The floor covering placed under the children's play structure shall exhibit a Class I interior floor finish classification, as described in Section 804, when tested in accordance with NFPA 253.

**[F] 424.3 Fire protection.** Children's play structures shall be provided with the same level of approved fire suppression and detection devices required for other structures in the same occupancy.

**424.4 Separation.** Children's play structures shall have a horizontal separation from building walls, partitions and from elements of the means of egress of not less than 5 feet (1524 mm). Children's playground structures shall have a horizontal separation from other children's play structures of not less than 20 feet (6090 mm).

**424.5 Area limits.** Children's play structures shall be not greater than 300 square feet (28 m<sup>2</sup>) in area, unless a special investigation, acceptable to the building official, has demonstrated adequate fire safety.

## SECTION 425 SPECIAL PROVISIONS FOR LICENSED 24-HOUR CARE FACILITIES IN A GROUP R-2.1, R-3.1, R-4 [SFM]

**425.1 Scope.** The provisions of this section shall apply to 24-hour care facilities in a Group R-2.1, R-3.1 or R-4 occupancy licensed by a governmental agency.

**425.2 General.** The provisions in this section shall apply in addition to general requirements in this code.

**425.2.1 Restraint shall not be practiced in a Group R-2.1, R-3.1 or R-4 Occupancies.**

**Exception:** Occupancies which meet all the requirements for a Group I-3 Occupancy.

**425.2.2 Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to occupancies classified as Residential Facilities (RF) and Residential Care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter**

county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for Residential Care Facilities for the Elderly.

**Exception:** Local regulations relating to roof coverings in facilities licensed as a residential care facility for the elderly (RCFE) per Health and Safety Code Section 13133.

#### 425.3 Building height and area provisions.

**425.3.1** Group R-2.1, R-3.1 and R-4 shall be constructed in accordance with Table 503.

**425.3.2 Limitations six or less clients.** Group R-3.1 occupancies where nonambulatory clients are housed above the first story, having more than two stories in height or having more than 3,000 square feet (279 m<sup>2</sup>) of floor area above the first story shall not be of less than one-hour fire-resistance-rated construction throughout.

In Group R-3.1 occupancies housing a bedridden client, the client sleeping room shall not be located above or below the first story.

**Exception:** Clients who become bedridden as a result of a temporary illness as defined in Health and Safety Code Sections 1566.45, 1568.0832 and 1569.72. A temporary illness is an illness, which persists for 14 days or less. A bedridden client may be retained in excess of the 14 days upon approval by the Department of Social Services and may continue to be housed on any story in a Group R-3.1 occupancy classified as a licensed residential facility.

Every licensee admitting or retaining a bedridden resident shall, within 48 hours of the resident's admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

**425.3.3 Limitations seven or more clients.** Group R-4 occupancies where nonambulatory clients are housed above the first story and there is more than 3,000 square feet (279 m<sup>2</sup>) of floor area above the first story or housing more than 16 clients above the first story shall be constructed of not less than one-hour fire-resistance-rated construction throughout.

**425.3.4 Nonambulatory elderly clients.** Group R-4 occupancies housing nonambulatory elderly clients shall be of not less than one-hour fire-resistance-rated construction throughout.

#### 425.4 Type of construction provisions.

**425.4.1** Group R-2.1, occupancies are not permitted in nonfire-resistance-rated construction, see Health and Safety Code Section 13131.5.

#### 425.5 Fire-resistance-rated construction provisions.

**425.5.1 Smoke barriers required.** Group R-2.1 and R-4 occupancies licensed as a Residential Care Facility (RCF) with individual floor areas over 6,000 square feet (557 m<sup>2</sup>) per floor, shall be provided with smoke barriers, constructed in accordance with Section 710.

Group R-2.1 occupancies housing bedridden clients shall be provided with smoke barriers constructed in accordance with Section 710 regardless of the number of clients.

When smoke barriers are required, the area within a smoke compartment shall not exceed 22,500 square feet (2090 m<sup>2</sup>) nor shall its travel distance exceed 200 feet (60 960 mm). Such smoke barriers shall divide the floor as equally as possible.

**425.5.2 Smoke partitions.** Group R-2.1 occupancies where smoke partitions are required, framing shall be covered with noncombustible materials having an approved thermal barrier with an index of not less than 15 in accordance with FM 4880, UL 1040, NFPA 286 or UL 1715.

**425.5.3 Independent egress.** At least two means of egress shall be provided from each smoke compartment created by smoke barriers. Means of egress may pass through adjacent compartments provided it does not return through the smoke compartment from which means of egress originated.

#### 425.6 Interior finish provisions.

**425.6.1 Interior wall and ceiling finish.** Group R-3.1 occupancies housing a bedridden client shall comply with interior wall and ceiling finish requirements specified for Group I-2 occupancies in Table 803.9.

**425.6.2 Safety padding.** Padding material used on walls, floors and ceilings in Group I and R-2.1 occupancies shall be of an approved type tested in accordance with the procedures established by State Fire Marshal Standard 12-8-100, Room Fire Test for Wall and Ceiling Materials, California Code of Regulations, Title 24, Part 12.

#### 425.7 Fire protection system provisions.

**425.7.1 Automatic sprinkler systems in Group R-2.1, R-3.1 and R-4 occupancies.** An automatic sprinkler system shall be installed where required in Section 903.

**425.7.2 Fire alarm systems in Group R-2.1 and R-4 occupancies.** An approved fire alarm system shall be installed where required in Section 907.

**425.7.3 Smoke alarms in Groups R-2.1, R-3.1 and R-4 occupancies.** Smoke alarms shall be installed where required in Section 907.2.11.1.

**425.7.4 Hearing impaired.** See Section 907.5.2.3.

#### 425.8 Means of egress provisions.

**425.8.1 General.** In addition to the general means of egress requirements of Chapter 10, this section shall apply to Group R-2.1, R-3.1 and R-4 occupancies.

**425.8.2 Number of exits.**

**425.8.2.1** Group R-2.1, R-3.1 and R-4 occupancies shall have a minimum of two exits.

**Exception:** Ancillary use areas or occupancies shall have egress as required by Section 1021.

#### **425.8.3 Egress arrangements.**

**425.8.3.1** Egress through adjoining dwelling units shall not be permitted.

**425.8.3.2 Group R-3.1 occupancies housing non-ambulatory clients.** In a Group R-3.1 occupancy, bedrooms used by nonambulatory clients shall have access to at least one of the required exits which shall conform to one of the following:

1. Egress through a hallway or area into a bedroom in the immediate area which has an exit directly to the exterior and the corridor/hallway is constructed consistent with the dwelling unit interior walls. The hallway shall be separated from common areas by a solid wood door not less than  $1\frac{3}{8}$  inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 715.4.8.
2. Egress through a hallway which has an exit directly to the exterior. The hallway shall be separated from the rest of the house by a wall constructed consistent with the dwelling unit interior walls and opening protected by a solid wood door not less than  $1\frac{3}{8}$  inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 715.4.8.
3. Direct exit from the bedroom to the exterior shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed, doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).
4. Egress through an adjoining bedroom which exits to the exterior.

**425.8.3.3 Group R-3.1 occupancies housing only one bedridden client.** In Group R-3.1 occupancies housing a bedridden client and not provided with an approved automatic sprinkler system, all of the following shall apply:

1. In Group R-3.1 occupancies housing a bedridden client, a direct exit to the exterior of the residence shall be provided from the client sleeping room.
2. Doors to a bedridden client's sleeping room shall be of a self-closing, positive latching  $1\frac{3}{8}$  inch solid wood door. Such doors shall be provided with a gasket so installed as to provide a seal where the door meets the jam on both sides and across the top. Doors shall be maintained self-closing or shall be automatic closing by actua-

tion of a smoke alarm in accordance with Section 715.4.8.

3. Group R-3.1 occupancies housing a bedridden client, shall not have a night latch, dead bolt, security chain or any similar locking device installed on any interior door leading from a bedridden client's sleeping room to any interior area such as a corridor, hallway and or general use areas of the residence in accordance with Chapter 10.
4. The exterior exit door to a bedridden client's sleeping room shall be operable from both the interior and exterior of the residence.
5. Every required exit doorway from a bedridden client sleeping room shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed in exit doorways, exit doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).

**Note:** A sliding glass door can be used as an exterior exit doorway as long as it is operable from the inside and outside and the clear width of the exit way is not less than 32 inches (813 mm).

**425.8.3.4 Intervening rooms.** A means of exit shall not pass through more than one intervening room. A means of egress shall not pass through kitchens, storerooms, closets, garages or spaces used for similar purposes.

**Exception:** Kitchens which do not form separate rooms by construction.

#### **425.8.4 Corridors.**

**425.8.4.1** Unless specified by Section 425.8.4, corridors serving Group R-2.1 and Group R-4 occupancies shall comply with Section 1018.1.

**425.8.4.2** The minimum clear width of a corridor shall be as follows:

1. Group R-2.1 occupancies shall have 60 inches (1524 mm) on floors housing nonambulatory clients and 44 inches (1118 mm) on floors housing only ambulatory clients.
2. Group R-4 occupancies shall have 44 inches (1118 mm) on floors housing clients.

#### **Exceptions:**

1. Corridors serving an occupant load of 10 or less shall not be less than 36 inches (914 mm) in width.
2. Corridors serving ambulatory persons only and having an occupant load of 49 or less shall not be less than 36 inches (914 mm) in width.
3. Group R-4 occupancies shall have 36 inches (914 mm) on floors housing clients.



In Group R-2.1 occupancies provided with fire sprinklers throughout and which are required to have rated corridors, door closers need not be installed on doors to client sleeping rooms.

**425.8.4.3** In a Group R-2.1 and Group R-4 occupancies having smoke barriers, cross-corridor doors in corridors 6 feet (1829 mm) or less in width shall have, as a minimum, a door 36 inches (914 mm) in width.

**425.8.5 Changes in level.** In Group R-3.1 occupancies housing nonambulatory clients interior changes in level up to 0.25 inch (6 mm) may be vertical and without edge treatment. Changes in level between 0.25 inch (6 mm) and 0.5 inch (12.7 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50 percent slope). Changes in level greater than 0.5 inch (12.7 mm) shall be accomplished by means of a ramp.

#### **425.8.6 Stairways.**

**425.8.6.1** Group R-2.1 and Group R-4 occupancies housing more than six nonambulatory clients above the first floor shall be provided with two vertical exit enclosures. Stairway enclosures shall be in compliance with Section 1020. Exceptions to Section 1020 shall not apply in facilities licensed as a 24-hour care facility.

**425.8.6.2** Group R-3.1 occupancies may continue to use existing stairways (except for winding and spiral stairways which are not permitted as a required means of egress) provided the stairs have a maximum rise of 8 inches (203 mm) with a minimum run of 9 inches (229 mm). The minimum stairway width may be 30 inches (762 mm).

**425.8.7 Floor separation.** Group R-3.1 occupancies shall be provided with a nonfire resistance constructed floor separation at stairs which will prevent smoke migration between floors. Such floor separation shall have equivalent construction of 0.5 inch (12.7 mm) gypsum wallboard on one side of wall framing.

#### **Exceptions:**

1. Occupancies with at least one exterior exit from floors occupied by clients.
2. Occupancies provided with automatic fire sprinkler systems complying with Chapter 9.

**425.8.7.1 Doors within floor separations.** Doors within such floor separations shall be tight fitting solid wood at least  $1\frac{3}{8}$  inches (35 mm) in thickness. Door glazing shall not exceed 1296 square inches (32 918 mm<sup>2</sup>) with no dimension greater than 54 inches (1372 mm). Such doors shall be positive latching, smoke gasketed and shall be automatic-closing by smoke detection.

**425.8.8 Fences and gates.** Grounds of a Residential Care Facility for the Elderly serving Alzheimer clients may be fenced and gates therein equipped with locks, provided safe dispersal areas are located not less than 50 feet (15 240 mm) from the buildings. Dispersal areas shall be sized to provide an area of not less than 3 square feet (0.28 m<sup>2</sup>) per occupant. Gates shall not be installed across corridors or passageways leading to such dispersal areas unless they comply with egress requirements.

**425.8.9 Basement exits.** One exit is required to grade level when the basement is accessible to clients.

**425.8.10 Delayed egress locks.** See Section 1008.1.8.6.

**425.9 Request for alternate means of protection for facilities housing bedridden clients.** Request for alternate means of protection shall apply to Sections 425 through 425.9. Request for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment, or means of protection shall be made in writing to the local fire authority having jurisdiction by the facility, client or the client's authorized representative. Sufficient evidence shall be submitted to substantiate the need for an alternate means of protection.

The facility, client or the client's representative or the local fire authority having jurisdiction may request a written opinion from the State Fire Marshal concerning the interpretation of the regulations promulgated by the State Fire Marshal for a particular factual dispute. The State Fire Marshal shall issue the written opinion within 45 days following the request.

Approval of a request for use of an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment, or means of protection made pursuant to this section shall be limited to Group R, 3.1 occupancies housing a bedridden client.

Approvals made by the local fire authority having jurisdiction and the written opinion by the State Fire Marshal shall be applicable only to the requesting facility and shall not be construed as establishing any precedent for any future request by that facility or any other facility.

**425.10 Temporarily bedridden clients.** Clients who become temporarily bedridden as defined in Health and Safety Code Section 1569.72, as enforced by the Department of Social Services, may continue to be housed on any story in Group R-2.1, R-3.1 or R-4 occupancies classified as Residential Care Facilities for the Elderly (RCFE). Every Residential Care Facility for the Elderly (RCFE) admitting or retaining a bedridden resident shall, within 48 hours of the resident's admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

## **SECTION 426 GROUP I-4 [SFM]**

**426.1 Group I-4 special provisions.** Rooms classified as Group I-4 shall not be located above or below the first story.

#### **Exceptions:**

1. Basements or stories having floor levels located within 4 feet (1219 mm), measured vertically, from adjacent ground level at the level of exit discharge, provided the basement or story has exterior exit doors at that level.
2. In buildings equipped with an automatic sprinkler system throughout, rooms used for kindergarten, first- and second-grade children or for day-care purposes may be located on the second story, pro-

vided there are at least two exterior exit doors, or other egress systems complying with Section 1017 with two exits, for the exclusive use of such occupants. Egress systems for the exclusive use of such occupants shall be maintained until exit discharge at grade is attained.

3. Group I-4 child-care facilities may be located above the first story in buildings of Type I construction and in Types II-A and III-A construction, subject to the limitation of Section 503 when:

- 3.1. Group I-4 childcare facilities with children under the age of seven or containing more than 12 children per story shall not be located above the fourth floor; and
- 3.2. The entire story in which the Group I-4 child-care facility is located is equipped with an approved manual fire alarm and smoke-detection system. (See the Fire Code.) Actuation of an initiating device shall sound an audible alarm throughout the entire story. When a building fire alarm system is required by other provisions of this code or the Fire Code, the alarm system shall be connected to the building alarm system. An approved alarm signal shall sound at an approved location in the Group I-4 child-care facility to indicate a fire alarm or sprinkler flow condition in other portions of the building; and
- 3.3 Group I-4 child-care facilities, if more than 1,000 square feet (92.9 m<sup>2</sup>) in area, is divided into at least two compartments of approximately the same size by a smoke barrier with door openings protected by smoke- and draft-control assemblies having a fire-protection rating of not less than 20 minutes. Smoke barriers shall have a fire-resistive rating of not less than one hour. In addition to the requirements of Section 508.3.3, occupancy separations between Group I-4 child-care and other occupancies shall be constructed as smoke barriers. Door openings in the smoke barrier shall be tightfitting, with gaskets installed as required by Section 710, and shall be automatic closing by actuation of the automatic sprinklers, fire alarm or smoke-detection system.
- 3.4. Each compartment formed by the smoke barrier has not less than two exits or exit access doors, one of which is permitted to pass through the adjoining compartment; and
- 3.5. Where two or more exits or exit access are required at least one shall not share a common path of travel.
- 3.6. The building is equipped with an automatic sprinkler system throughout.

## **SECTION 427**

### **Reserved**

## **SECTION 428**

### **Reserved**

## **SECTION 429**

### **Reserved**

## **SECTION 430**

### **HORSE RACING STABLES [SFM]**

**430.1** For automatic sprinkler and fire alarm system requirements applying to each building, barn or structure which is used by an association regulated by the California Horse Racing Board for the stabling of horses or human habitation, and the stable area grounds, including any additional location where any excess horses are stabled see Title 4, Division 4, Article 17, Section 1927.

## **SECTION 431**

### **PET KENNELS [SFM]**

**431.1** These regulations shall apply to every building or fire area in which a pet dealer, as defined in Health and Safety Code Section 122125, maintains a kennel.

**431.2 Automatic sprinkler system.** An approved automatic sprinkler system complying with California Fire Code Section 903 shall be installed.

**Exception:** Where a fire alarm system that is connected to a central reporting station that alerts the local fire department in case of fire.

## **SECTION 432**

### **COMBUSTION ENGINES AND GAS TURBINES [SFM]**

**432.1 General.** The installation of combustion engines and gas turbines shall be in accordance with NFPA-37 and this chapter.

#### **432.2 Separation.**

**432.2.1 Construction.** Every room in which is installed a combustion engine or gas turbine shall be separated from the remainder of the building by not less than a one-hour fire barrier.

**432.2.2 Exterior openings.** When doors, windows or lowered openings are located below openings in another story or less than 10 feet (3048 mm) from doors, windows or lowered openings of the same building, they shall be protected by a fire assembly having a <sup>3</sup>/<sub>4</sub>-hour rating. Such fire assemblies shall be fixed, automatic or self-closing.

**432.2.2.1 Interior openings.** In other than buildings housing Group I and R-2.1 occupancies, interior openings shall be allowed in buildings protected by an automatic fire sprinkler system throughout.

**432.2.3 Location.** Combustion engines and gas turbines used for emergency power shall not be located in a room or area used for any other purpose other than equipment

and controls related to the generation and distribution of emergency power.

**432.2.4 Special hazards.** The handling and use of flammable or combustible liquids shall comply with the California Fire Code.

## SECTION 433

### FIXED GUIDEWAY TRANSIT SYSTEMS [SFM]

#### 433.1 General.

**433.1.1 Scope.** The provisions of this section shall apply to buildings or structures defined as stations for fixed guideway transit systems and shall supersede other similar requirements in other sections of this code.

**433.1.2 Definitions.** For the purpose of this section, certain terms are defined as follows:

**AT-GRADE STATION.** Any at-grade or unroofed station other than an elevated or underground station.

**ELEVATED STATION.** A station greater than one story not otherwise defined as an at-grade or underground station.

**EMERGENCY MANAGEMENT PANEL (EMP).** The location where all necessary on-site control and communication facilities are consolidated for effective response to emergency situations.

**ENCLOSED STATION.** A station or portion thereof that does not meet the definition of an open station.

**ENGINEERING ANALYSIS (FIRE HAZARD/FIRE RISK ASSESSMENT).** An analysis that evaluates all various factors that affect the fire safety of the system or component. A written report of the analysis shall indicate the fire protection method(s) recommended that demonstrates a level of fire safety commensurate with this standard.

**FIXED GUIDEWAY TRANSIT SYSTEM (the system).** An automated driverless or manually controlled electrified transportation system, utilizing a fixed guideway, operating on right-of-way for the mass movement of passengers and consisting of its fixed guideways, transit vehicles and other rolling stock; power system; buildings; maintenance facilities; stations; transit vehicle yard; and other stationary and movable apparatus, equipment, appurtenances and structures.

**GUIDEWAY.** That portion of the system on which the transit vehicles operate.

**OPEN STATION.** A station that is constructed in such a manner that it is open to the atmosphere, and smoke and heat are allowed to disperse directly into the atmosphere. The following enclosed areas in open stations are permitted but limited to:

1. Ticket/pass booths not exceeding 150 square feet (13.9 m<sup>2</sup>) in area.
2. Mechanical and electrical spaces typically not used for human occupancy and necessary for the operation of a fixed guideway transit system. Such spaces shall be limited to two per level.

3. Restrooms not exceeding 150 square feet (13.9 m<sup>2</sup>) in area. A maximum of four restrooms are permitted per level.

**OPERATIONS CONTROL CENTER (OCC) (CENTRAL CONTROL).** The operation center where the authority controls and coordinates the system-wide movement of passengers and trains from which communication is maintained with supervisory and operating personnel of the authority, and with participating agencies when required.

**POINT OF SAFETY.** An enclosed fire exit that leads to a public way or safe location outside the structure, or an at-grade point beyond any enclosing structure, or other area that affords adequate protection for passengers.

**POWER SUBSTATION.** The location of electric equipment that does not generate electricity but receives and converts or transforms generated energy to usable electric energy.

**STATION.** A place designated for the purpose of loading and unloading passengers, including patron service areas and ancillary spaces associated with the same structure.

**STATION PLATFORM.** The area of a station used primarily for loading and unloading transit vehicle passengers.

**UNDERGROUND STATION.** A station or that part of a station located beneath the surface of the earth or of the water.

#### 433.2 Types of Construction.

**433.2.1** Unless otherwise specified in this section, buildings or portions of buildings classed as stations of fixed guideway transit systems shall be minimum Type IA, Type IB or Type II-A construction and shall not exceed in area or height the limits specified in Table 503.

Underground stations shall be a minimum Type I or Type I-B constructions.

Open stations may be of Type II-B construction and shall not exceed in area or height as required by Table 503 for Type II-A.

**Exception:** At-grade structures of open stations with an occupancy load not exceeding 300 persons may be of any construction type permitted by this code.

#### 433.2.2 Mixed occupancies.

**433.2.2.1** Stations of fixed guideway transit systems shall be separated from other occupancies in accordance with Table 508.4 for Group A Occupancies.

**433.2.2.2** The following areas shall be separated from public areas by a two-hour fire barrier:

1. Electrical control rooms, auxiliary electrical rooms and associated battery rooms
2. Trash rooms
3. Train control rooms and associated battery rooms
4. Fan rooms

## 5. Emergency generator rooms

**433.2.2.3** Within station structures, all power substations shall be separated from all other areas by a three-hour fire barrier with no openings to public areas.

### 433.3 Access and exit facilities.

**433.3.1 Occupant load.** The occupant load for a transit station shall be based on the emergency condition requiring evacuation of that station to a point of safety. The station occupant load shall be the sum of the number of persons in the calculated train load of trains entering a station plus the entraining load of persons awaiting train(s), during a specified time period. Notwithstanding, the minimum occupant load shall not be less than the maximum capacity load of a train which would occupy the entire length of the station platform on a single track. Exiting shall be provided for occupant loads recalculated upon increase in service and/or every five years.

**433.3.1.1 Calculated train load.** The calculated train load is the number of passengers on trains simultaneously entering the station on all tracks in normal traffic direction during the peak 15-minute period.

The following limitations to the calculated train load shall be applied:

1. No more than one train will unload at any one track to a platform during an emergency.
2. The load on any single train is limited to the maximum train capacity.

**433.3.1.2 Entraining load (on platform awaiting train).** The entraining load is equal to the number of passengers that would accumulate on the platform in the time period equivalent to two headways or 12 minutes during the peak 15-minute period, whichever time period is greater.

This entraining load is constrained as stated as follows:

1. Special consideration shall be given to stations servicing areas where events occur that establish occupant loads not included in normal passenger loads. These would include such areas as civic centers, sports complexes and convention centers.
2. At multiplatform stations, each platform shall be considered separately. Arrival of trains from all normal traffic directions, plus their entraining loads, shall be considered.
3. At concourses, mezzanines or multilevel stations, simultaneous platform loads shall be considered for all exit lanes passing through that area.

### 433.3.2 Exits required.

**433.3.2.1 Number of exits.** Stations shall have at least two exits placed a distance apart equal to not less than one half of the length of the maximum overall diagonal

dimension of the station. Enclosed station platforms shall have a minimum of one exit within 20 feet (6096 mm) from each end. Underground station platforms shall have a minimum of one enclosed exit within 20 feet (6096 mm) from each end. Routes from platform ends into the underground guideway shall not be considered as exits for calculating exiting requirements.

### 433.3.2.2 Capacity of exits and station evacuation time.

**433.3.2.2.1** Exit capacities shall be calculated on the basis of 22-inch-wide (559 mm) exit lanes at the clear and narrowest point except that individual handrails may project into the required width as permitted by Chapter 10. Fractional lanes shall not be counted in measuring exit capacities except that 12 inches (305 mm) added to one or more lanes shall be counted as one-half a lane. Escalators 32 inches (813 mm) in width may be considered as 1½ lanes.

**433.3.2.2.2** There shall be sufficient means of exit to evacuate the station occupant load from the station platforms in four minutes or less.

**433.3.2.2.3** The station shall also be designed to permit evacuation from the most remote point on the platform to a point of safety in six minutes or less.

**433.3.2.2.4** In at-grade or elevated structures so designed that the station platform is open to the elements and, when the concourse is below or protected from the platform by distance or materials as determined by an appropriate engineering analysis, that concourse may be defined as a point of safety, with Fire Code Official concurrence.

**433.3.2.2.5** To calculate evacuation time, the walking travel time should be tabulated using the longest exit route and travel speeds. To this time should be added the following factors:

1. The waiting time at the vertical elements at platform level minus the longest walking travel time at platform level.
2. The waiting time at the fare collection barriers minus the waiting time at the platform vertical circulation elements.
3. The waiting time at the vertical or horizontal circulation elements from mezzanine to grade minus the waiting time at the platform vertical circulation elements or fare collection barrier, whichever is greater.
4. The waiting time, if any, at any additional constriction minus the greatest previous waiting time. (Repeat for all additional constrictions.)

**Note:** The total of any of the factors in Items 1 through 4 above cannot be less than zero.

**433.3.3 Exit width and exit lanes.**

**433.3.3.1** The capacity in persons per minute (ppm), patron travel speeds in feet per minute (fpm) and requirements for exit lanes shall be as follows:

1. Platforms, corridors and ramps of 1 foot vertical for 20 feet horizontal (5 percent slope) or less: Exit corridors, platforms and ramps shall be a minimum clear width of 5 feet (1524 mm). In computing the number of exit lanes available, 1 foot 6 inches (457 mm) shall be deducted at each platform edge and 1 foot (305 mm) at each side wall.

Per exit lane:

Capacity – 50 ppm

Travel speed – 200 fpm

2. Stairs, stopped escalators and ramps of over 1 foot vertical for 20 feet horizontal (5 percent slope): Exit ramps shall be a minimum clear width of 6 feet (1829 mm). Stopped escalators may be considered as a means of egress, provided they are of nominal 2 feet 8 inches (813 mm) width.

Per exit lane “up” direction:

Capacity – 35 ppm

Travel speed – 50 fpm\*

Per exit lane “down” direction:

Capacity – 40 ppm

Travel speed – 60 fpm\*

3. Doors and gates: Gates fitted with approved panic hardware and opening in the direction of exit travel, with minimum nominal width of 3 feet (914 mm) shall be permitted in exit calculation.

Per doors and gate:

Capacity – 50 ppm per exit lane

4. Fare collection gates: Fare collection gates, when deactivated, shall provide a minimum 20 inches (508 mm) clear unobstructed aisle. Console shall not exceed 40 inches (1016 mm) in height.

Per gate:

Capacity – 50 ppm

**Note:** Examples of exiting analysis may be found in Appendix C of NFPA 130, 1995 edition, Standard for Fixed Guideway Transit Systems.

\*Indicates vertical component of travel speed.

**433.3.4 Arrangement of exits.**

**433.3.4.1 Vertical circulation elements shall be comprised of stairs or stair/escalator combinations.** Escalators shall not account for more than half of the units of exit at any one level in the public area. Escalators must be paired in combination with stairs to be included in exiting capacity calculations.

**433.3.4.2** Because of the possibility of maintenance or malfunction, one escalator at each station shall be considered as being out of service in calculating egress requirements. The escalator chosen shall be that one having the most adverse effect on exiting capacities.

**433.3.5 Distance to exits.** No point of the station platform(s) or mezzanine(s) shall be more than 300 feet (91 440 mm) from a point of safety.

**433.3.6 Other exits required/guideway access.**

**433.3.6.1** Access/egress between guideway and platforms shall be provided as follows:

1. Stairs or ramps, 2 feet 10 inches (864 mm) in width minimum, or other arrangement having equivalent capacity, shall be provided at each end of the platform, arranged to provide access/egress to guideway level.
2. Except in underground stations, the access points between the guideway and the platform, and the exit from the platform may be integrated.

**433.3.6.2** In enclosed stations, escalator and stairway enclosures are not required in the public areas of multilevel transit stations among platform, mezzanine and concourse when the station is provided with an emergency ventilation system.

**433.3.7 Emergency lighting and exit signs.**

**433.3.7.1** Emergency lighting and exit signs shall be provided in accordance with Chapter 10.

**Exception:** Open stations at grade need not provide emergency lighting or exit signs.

**433.4 Special provisions.**

**433.4.1 Automatic sprinkler system.** See Section 903.2.17.1.

**433.4.2 Station guideway deluge system.** See Section 903.2.17.1.

**433.4.3 Standpipe systems.** See Section 905.3.10.

**433.4.4 Emergency management panel (EMP).** An EMP shall be required for enclosed and underground stations. Location of the EMP shall be determined by the Fire Code Official. The EMP shall include but not be limited to the following:

1. Indication of manual pull boxes and automatic smoke detectors
2. Indication of alarm signals from all suppression systems
3. Capabilities for using station paging system
4. Emergency telephone
5. Escalator controls
6. Emergency ventilation controls
7. Station schematics

**433.4.5 Emergency ventilation systems.**

**433.4.5.1 General.** Emergency ventilation shall be provided for enclosed and underground stations for the

protection of passengers, employees and emergency personnel.

**433.4.5.2** These systems shall be designed as follows:

1. A stream of noncontaminated air is provided to passengers in a path(s) of egress away from a train fire; and
2. Airflow rates produced toward a train fire in a path of egress are sufficient to prevent back layering of smoke; and
3. The temperature in a path of egress away from a train fire is limited to 140°F (60°C), or less; and
4. The design heat release rate produced by a train fire shall be used to design the emergency ventilation system.

**433.4.5.3** Ventilation shaft terminals at-grade shall be located to prevent recirculation as follows:

1. Openings for blast relief shafts, and under platform and smoke exhaust shafts at-grade shall be separated by a minimum horizontal distance of 40 feet (12 192 mm) from any station entrance, elevator hoistway enclosure, surface emergency stair doorway, unprotected outside air intake or other opening, or from each other. Exhaust outlets that are not used for intakes may be adjacent to each other.
2. Where this distance is not practical, the horizontal distance may be reduced to 15 feet (4572 mm) if the closest blast relief or under platform and smoke exhaust shaft terminal is raised a minimum of 10 feet (3048 mm) above the station entrance, emergency stair doorway and unprotected outside air intake or other opening, or the underplatform and smoke exhaust shaft terminal is raised a minimum of 10 feet (3048 mm) above the blast relief shaft terminal.
3. Ventilation of stations shall not terminate at grade on any vehicle roadway.

**433.4.5.4** Emergency ventilation fans.

**433.4.5.4.1** Ventilation fans used for emergency service, their motors, dampers and all related components exposed to the ventilation airflow shall be designed to operate in an ambient atmosphere of 482°F (250°C) for a period of at least one hour. Ventilation fans and related components shall be capable of withstanding the maximum anticipated plus/minus pressure transients induced by train operations.

**433.4.5.4.2** Local fan motor starters and related operating control devices for emergency ventilation equipment shall be isolated from the ventilation airflow by a separation having a fire-resistance rating of at least one hour.

**433.4.5.4.3** Thermal overload protective devices shall not be provided on motor controls of fans used for emergency ventilation.

**433.4.5.4.4** The power supply for fans essential for emergency ventilation service shall consist of two separate electrical feeders. Each feeder shall originate from a different source (substation) and shall be separated physically to the extent possible. Automatic transfer shall be provided in the event the normal supply source fails.

**433.4.5.4.5** Operation and fail-safe verification for proper operation of emergency fans shall be affected from the operation control center with indication provided for all modes of operation for each fan.

**433.4.5.5** Emergency ventilation control.

**433.4.5.5.1** Local controls shall override remote control. Local control shall be capable of operating the fans in all modes in the event the remote controls become inoperative.

**433.4.5.5.2** Emergency ventilation systems shall be supervised and/or controlled in all operating modes locally (motor control center and/or fan unit) and remotely at both the OCC and the station EMP.

**433.4.5.5.3** Fan running shall be provided by sensing devices for each fan for operation in both the supply and exhaust directions.

**433.4.5.5.4** Trouble status signals shall be annunciated in the local control room. A summarized trouble signal shall be annunciated at OCC and EMP.

**433.4.5.6** Ventilation systems and ancillary areas. Ancillary area ventilation systems shall be arranged so that air is not exhausted into station public occupancy areas.

**433.5** Fire Alarm and Communication Systems. See Section 907.2.26.

## SECTION 434 EXPLOSIVES [SFM]

**434.1** General construction requirements. Magazines shall be constructed in conformity with the provisions of these regulations, or may be of substantially equivalent construction satisfactory to the enforcing agency having jurisdiction. Reasonable allowances shall be made for storage facilities in existence prior to the adoption of these regulations. No allowance, however, shall be made for storage facilities which constitute a distinct hazard to life and property.

**434.2** Ventilation and weather resistance. Magazines for the storage of explosives shall be sufficiently ventilated and weather resistant and when used for the storage of Class A explosives (other than black powder, blasting agents, blasting caps and electric blasting caps), they shall also be of bullet-resistant construction unless deemed exempt by the enforcing agency having jurisdiction.

**Note:** The recommendation for ventilation as contained in Pamphlet No. 1, Institute of Makers of Explosives, 1965 edition, is evidence of good practice.

**434.3 Construction for separation between primers and flammable liquids.** Primers shall be separated from flammable liquids by a one-hour fire-resistive occupancy separation.

**Exception:** A separation need not be provided for small arms ammunition primers when such primers are located a distance of not less than 25 feet (7620 mm) from flammable liquids.

**434.4 Construction of Type I Magazine.** Type I magazines shall be of bullet-resistant construction. Plans shall be submitted to the enforcing agency having jurisdiction for approval prior to construction.

**434.4.1 General.** Use of the following materials and methods of construction shall be evidence of compliance with this requirement:

1. Masonry units not less than 8 inches (203 mm) in thickness with all hollow spaces filled with weak cement, well-tamped sand, or equivalent material; or
2. Reinforced concrete not less than 6 inches (152 mm) in thickness; or
3. Steel walls of minimum No. 14 manufacturers. Standard gage (0.0747 inch) (1.9 mm) to No. 6 manufacturers. Standard gage (0.1943 inch) (4.9 mm) may be used, provided there are two layers spaced at least 6 inches (152 mm) apart with all hollow spaces filled with weak cement, well-tamped sand or equivalent material; or
4. One layer of No. 6 manufacturer's standard gage (0.1943 inch) (4.9 mm) or heavier; steel lined on the interior with a minimum of 4 inches (102 mm) of wood; or
5. Two layers of No. 6 manufacturer's standard gage (0.1943 inch) (4.9 mm) or heavier steel spaced a minimum  $\frac{1}{2}$  inch (12.7 mm) apart and lined on the interior with a minimum of 2 inches (51 mm) of wood; or
6. Two layers of wood, at least 2 inches (51 mm) nominal thickness each, spaced a minimum 4 inches (102 mm) apart with the hollow space filled with weak cement, well-tamped sand or equivalent material.
7. Wood used shall conform to the following:

Wood shall be of tongue-and-grooved lumber or plywood. Wood shall be covered, on the exterior side, with metal to provide protection against flying embers and sparks.

**434.4.2 Doors.** Doors shall be of bullet-resistant construction. Each door is to be equipped with:

1. Two mortise locks;
2. Two padlocks fastened in separate hasps and staples;
3. A combination of a mortise lock and a padlock;
4. A mortise lock that requires two keys to open; and
5. A three-point lock.

Padlocks must have at least five tumblers and a case-hardened shackle of at least  $\frac{3}{8}$ -inch (9.5 mm) diameter. Padlocks must be protected with not less than  $\frac{1}{4}$ -inch (6.4 mm) steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock or bar that cannot be actuated from the outside.

**434.4.3 Floors.** Floors of magazines shall be securely fastened in place and shall be capable of withstanding the loads imposed.

**434.4.4 Roofs.** Roofs shall be securely fastened in place and they shall be bullet resistant, if required by the fire chief having jurisdiction.

**434.4.5 Ventilation openings.** Ventilation openings shall be screened to prevent the entrance of sparks and they shall be protected in a manner that will maintain the bullet resistance of the magazine.

**434.4.6 Interiors.** Magazine interiors shall be of a smooth finish without cracks or crevices with all nails, screws, bolts and nuts countersunk. Exposed metal capable of emitting sparks shall be covered so as not to come in contact with packages of explosives.

**434.4.7 Location.** No Type I magazine, or portion thereof, shall be located under a high-voltage power line (750 volts or more). For the purposes of this section, "under" shall include an open space of not less than the height of the power line from the ground at right angles to the walls of the magazine.

**434.5 Buildings used for mixing of blasting agents.** Buildings used for the mixing of blasting agents shall conform to the requirements of Sections 434.5 and 434.6, unless otherwise specifically approved by the enforcing agency having jurisdiction.

**434.5.1 Construction.** Buildings shall be of all noncombustible construction or of sheet metal on wood studs.

**434.5.2 Separation.** The layout of the mixing building shall be such so as to provide physical separation between the finished product storage and the mixing and packaging operations.

**434.5.3 Storage areas.** Floors in storage areas and in the processing plant shall be of concrete or other noncombustible material. Isolated fuel storage shall be provided to avoid contact between molten ammonium nitrate and fuel in case of fire.

**434.5.4 Ventilation.** The building shall be well ventilated in accordance with Section 434.2.

**434.5.5 Heat.** Heat, if used, shall be provided exclusively from a unit outside of the building.

**434.5.6 Venting.** Explosion venting shall be provided when required by the enforcing agency having jurisdiction.

**434.6 Building construction storage.** Blasting agents may be stored in the manner set forth in Title 19, California Code of

Regulations, Subchapter 10, Article 3, or in one-story warehouses (without basements), which shall be:

1. Of noncombustible or one-hour fire-resistive construction;
2. Constructed so as to eliminate floor drains and piping into which molten materials could flow and be confined in case of fire;
3. Weather resistant;
4. Well ventilated in accordance with Section 434.2; and
5. Equipped with a substantially constructed and lockable door which shall be kept securely locked, except when the facility is open for business.

**434.7 Electrical requirements for Type I magazines.** Magazines shall not be provided with either heat or light, except upon the approval of the enforcing agency having jurisdiction. Electrical installation, when permitted, shall be in accordance with the California Electrical Code for Type II, Division I locations.

**434.8 Mixing room blasting agents.** All electrical switches, controls, motors and lights, if located in the mixing room, shall be installed in accordance with the California Electrical Code for Type II, Division I locations.

**434.9 Storage of special effects materials.** The storage of not more than 750 pounds (340 kg) of special effects materials shall be in a building or a room conforming to the requirements of Group H, Division I Occupancies as defined in this part. In addition, the following shall apply to every special effects materials storage building or room:

1. The building shall be sprinklered as required in Chapter 9.
2. It shall be deemed that the storage of special effects materials creates an atmosphere of flammable dust.
3. Two or more permanent openings having an area of not less than 100 square inches (64 500 mm<sup>2</sup>) shall be located in the exterior wall to provide natural ventilation. These openings shall be protected by screens or louvers covered with 1/4-inch (6.4 mm) wire mesh screen.
4. Walls, floor ceiling, shelves and benches shall have a smooth nonmetallic surface which can be easily cleaned with a minimum of brushing or scrubbing.
5. Each entrance door shall be posted on the outside with signs stating, "Authorized Personnel Only" and "No Smoking."
6. Assembling and manufacturing are prohibited in special effects storage rooms or buildings.
7. The room shall be located above grade in a one-story building or on the top floor of a multistory building or may be a separate building.
8. The room or building shall have a minimum floor area of 80 square feet (7.4 m<sup>2</sup>) with no dimension less than 8 feet (2438 mm).
9. Electric wiring, lighting and heating shall be of a type approved for use in hazardous locations.

**434.10 Mixing room or building.** Buildings or rooms in which more than 50 pounds (22.7 kg) of special effects materials are present at any time shall be constructed with at least one wall of explosion-relief type. The relief wall should be placed so as to be of least hazard to persons in adjacent buildings.

**434.10.1 Explosive venting.** When explosive venting is required, the venting area will be calculated on 1 square foot (0.0929 m<sup>2</sup>) for each 35 cubic feet (0.99 m<sup>3</sup>) of building or roof area.

**434.10.2 Egress.** All rooms or buildings shall have adequate aisle space and at least two exits separated by a distance equal to at least one-fifth the perimeter of the room. Openings in fire walls shall be equipped with approved, self-closing fire doors. All exit doors shall open outward and be equipped with approved panic hardware.

**Exception:** Cubicles 100 square feet (9.3 m<sup>2</sup>) or less and occupied by not more than two persons working within 12 feet (3658 mm) of an unobstructed passageway may have one exit.

**434.10.3 Room finishes.** Floors, walls, interior surfaces and equipment shall be of a finish and color that will indicate the presence of dust and spilled material. They shall be smooth finished for easy cleaning.

**434.10.4 HVAC.** Heating and cooling shall be by the indirect method using water, steam, electric heaters or other indirect methods.

**Note:** Floor registers shall not be permitted.

**434.10.5 Electrical.** All electrical wiring and equipment shall be acceptable for the hazard involved and installed in accordance with Hazardous Locations, California Electrical Code.

**434.10.6 Grounding.** Effective bonding and grounding means shall be provided to prevent accumulation of static charges where static charges are a hazard, as set forth in the California Electrical Code.

**434.10.7 Pressure relief valves.** Hydraulic or air presses and hand jacks shall be provided with pressure-relief valves so arranged and set that the material being processed will not be subjected to pressure likely to cause it to explode. Dies and plugged press equipment shall not be cleared by striking blows that may detonate or start the material burning.

**434.10.8 Dust control.** Dust from special effects materials shall not be exhausted to the atmosphere. Where vacuum dust collections systems are used, they shall comply with the following requirements:

1. Adequate filters must be installed between the source vacuum and the point of pickup to prevent explosive special effects materials from entering the vacuum pump or exhauster.
2. The dust-collection system shall be designed to prevent pinch points threaded fittings exposed to the hazardous dust and sharp turns, dead ends, pockets, etc., in which special effects materials may lodge and accumulate outside the collecting chamber.



3. The entire vacuum collection system shall be made electrically continuous and be grounded to a maximum resistance of 5 ohms.
4. Chambers in which the dusts are collected shall not be located in the operating area unless adequate shields for the maximum quantity of material in the collector are furnished for personnel protection.
5. No more than two rooms may be serviced by a common connection to a vacuum collection chamber. Where interconnections are used, means should be employed to prevent propagation of an incident via the collection piping.
6. When collecting the more sensitive special effects materials, such as black powder, lead azide, etc., a "wet" collector which moistens the dust close to the point of intake and maintains the dust wet until removed for disposal shall be used. Wetting agents shall be compatible with the explosives.
7. Dusts shall be removed from the collection chamber as often as necessary to prevent overloading. The entire system shall be cleaned at a frequency that will eliminate hazardous concentrations of dusts in pipes, tubing and/or ducts.

**434.10.9 Fans.** Squirrel cage blowers should not be used for exhausting hazardous fumes, vapors or gases. Only nonferrous fan blades are permitted for fans located within the ductwork and through which hazardous materials are exhausted. Motors shall be located outside the duct.

**434.10.10 Work stations.** Work stations for small amounts of special effects materials [less than 1 pound (0.454 kg)] shall be separated by distance, barrier or other means, so fire in one station will not ignite material in the next work station. When necessary, each operator shall be protected by a personnel shield located between the operator and the material being processed. This shield and its support shall be a test design to withstand a blast from the maximum amount of special effects materials allowed behind it.

**434.10.11 Shielding.** When shields or structures are needed to protect personnel, the following requirement shall be followed when specific weights of special effects materials in the amount of 1 pound (0.454 kg) or more are involved:

Weight of Explosive	Structure of Shield Wall
1-15 pounds (0.454-6.8 kg)	Shield wall constructed of concrete not less than 12 inches (305 mm) thick which is reinforced near both sides by rods not less than 1/2 inch (12.7 mm) in diameter located on maximum centers of 12 inches (305 mm) both horizontally and vertically. The rods must be staggered on opposite faces.
More than 15 pounds (6.8 kg)	The shield wall for the protection of workers must be designed in such a manner to protect against the efforts of not less than 25 percent overload above the expected maximum charge to be processed.

#### Notes:

1. One inch (25 mm) of mild steel is equivalent to 1 foot (305 mm) of reinforced concrete.
2. Explosives shall be located not less than 36 inches (914 mm) from the wall and 24 inches (610 mm) above the floor.

If this personnel protection wall for the required operation involving large quantities of special effects materials becomes so large that it is impractical, the operator must perform the operations by remote control or be protected by a suitably constructed shelter designed with a safety factor of not less than 4 to withstand the overpressure from the maximum amount of explosives in process.

## SECTION 435 RESERVED

## SECTION 436 WINERY CAVES [SFM]

**436.1 Scope.** The use of subterranean space for winery facilities in natural or manmade caves shall be in accordance with this section.

#### 436.2 Definitions.

**436.3 General.** For definitions of ASSEMBLY, FIRE APPLIANCE and NONCOMBUSTIBLE, see Chapter 2.

**436.4 Limited application.** For the purpose of Section 436, certain terms are defined as follows:

**TYPE 1 WINERY CAVES** are natural or manmade caves used solely for storage and/or processing of wine at a winery facility. Type 1 winery caves are not accessible to the public.

**TYPE 2 WINERY CAVES** are natural or manmade caves used for the storage and/or processing of wine at a winery facility. Type 2 winery caves are accessible to the public on guided tours only.

**TYPE 3 WINERY CAVES** are natural or manmade caves used for the storage and/or processing of wine at a winery facility. Type 3 winery caves are accessible to the public on guided tours and contain assembly use areas.

**436.5 Permits.** For permits to operate Type 2 and 3 winery caves, see Section 105.

**436.6 Fire apparatus access roads.** Fire apparatus access roads shall be constructed and maintained in accordance with the California Fire Code, Section 503.

#### 436.7 Construction requirements.

**436.7.1 Allowable area.** The area of winery caves shall not be limited if constructed entirely of noncombustible materials. Winery caves constructed with combustible materials shall be limited in area so that no point is more than 150 feet (45 720 mm) from an exit.

**436.7.2 Interior construction.** The walls and ceilings of winery caves shall not contain hidden or concealed spaces.

#### 436.8 General requirements.

**436.8.1 Public tours.** Tours for the public shall be continuously guided by staff knowledgeable in the location of exits and the use of emergency notification devices.

**436.8.2 Standby personnel.** Per the California Fire Code, Section 2404.20, when, in the opinion of the fire chief, it is essential for public safety, the owner, agent or lessee shall employ one or more qualified persons, as required and approved by the chief, to be on duty at such place. Such individuals shall be in uniform or otherwise easily identifiable.

Standby personnel shall be subject to the fire chief's orders at all times when so employed and shall remain on duty during the times such places are open to the public or when such activity is being conducted.

Before the start of any activity requiring standby personnel, such individuals shall:

1. Inspect the required fire appliances to ensure they are in the proper place and in good working order.
2. Inspect all exits to verify accessibility and proper operation.

While on duty, such individuals shall not be required or permitted to perform any duties other than those specified by the fire chief.

**436.8.3 Open-flame devices.** The use of candles and other open-flame devices shall be in accordance with California Fire Code Section 308.1.7.

**436.9 Portable fire extinguishers and other fire appliances.** Portable fire extinguishers shall be located to be readily accessible. Its type, location and spacing throughout the facility shall be in accordance with the provisions of Title 19, Chapter 3 and California Fire Code Section 906.1. Other fire appliances shall be maintained at the site as required by the fire chief.

**436.10 Fire alarm systems.** An approved manual fire alarm system conforming with the provisions of the California Fire Code, Section 907.2.1 shall be provided in all Type 3 winery caves.

#### **436.11 Exits.**

**436.11.1 Distribution.** Exits shall be located remotely from each other and arranged to minimize any possibility that more than one may be blocked off by any one fire or other emergency condition.

**436.11.2 Number.** Winery caves shall be provided with a minimum of two exits.

Assembly areas of Type 3 winery caves shall be provided with exits as required by the California Building Code for Group A Occupancies.

#### **436.12 Exit illumination.**

**436.12.1 General.** Exits shall be illuminated to a minimum intensity of not less than 1 foot-candle (10.76 lx) at floor level whenever the winery cave is occupied. Fixtures providing exit illumination shall be supplied from a dedicated circuit or source of power used only for exit illumination.

**436.12.2 Separate sources of power.** The power supply for exit illumination may be provided by the premises' wiring system. In the event of its failure, illumination shall be automatically provided from an emergency system in Types 2 and 3 winery caves. Emergency systems shall be supplied from storage batteries or an on-site generator set, and the system shall be installed in accordance with the requirements of the California Electrical Code.

**436.13 Exit signs.** Exit signs shall be installed at required exits and where otherwise necessary to clearly indicate the exits from assembly areas in Type 3 winery caves.

**436.14 Maximum occupant load.** Occupant load requirements in the assembly areas of Type 3 winery caves shall be in accordance with Section 1004.

**436.15 Seating arrangements.** Seating arrangements in the assembly areas of Type 3 winery caves shall be in accordance with California Fire Code, Section 1028.9.

### **SECTION 437 RESERVED**

### **SECTION 438 RESERVED**

### **SECTION 439 PUBLIC LIBRARIES [SL AND SFM]**

Public libraries funded from the California Library Construction and Renovation Act of 1988.

**439.1 Automatic sprinkler system.** Automatic sprinkler systems shall be installed in:

1. New facilities, including additions;
2. Existing facilities to which a project adds the lesser of 5,000 square feet (465 m<sup>2</sup>) or 10 percent of the size of the existing facility, if the existing facility does not already have an automatic sprinkler system.

**439.2 System monitoring requirement.** All fire protection systems shall be monitored by a fire alarm supervising station in accordance with the NFPA 72.

**439.3 Book return slots.** Any interior book return with a slot piercing the exterior wall shall have a separate sprinkler head and be enclosed in fire-rated construction.

**439.4 Automatic sprinkler and extinguishing systems.** For public libraries constructed with funds awarded under the California Reading and Literacy Improvement and Public Library Construction and Renovation Bond Act of 2000:

1. **Fire sprinkler system requirement.** All libraries funded for new construction, including additions, shall have automatic fire sprinkler systems installed.
2. **Fire sprinkler system requirement for renovations of existing facilities.** If there is no automatic fire sprinkler system in the existing facility, grant recipients shall be required to install a fire sprinkler system throughout the existing facility.

3. **Fire sprinkler system types.** The grant recipient may choose, on approval by the local fire authority, from wet-pipe, dry-pipe or pre-action systems, utilizing listed standard, early suppression fast response (ESFR), or on/off type sprinkler heads.
4. **Book return rooms and slots.** Book return rooms with slots in exterior walls shall have an automatic sprinkler head and be of approved fire-resistive construction. Book return slots and book drops shall have an additional automatic sprinkler head when shielded from the room sprinkler head.
5. **System monitoring requirement.** All fire protection systems shall be monitored by a fire alarm supervising station in accordance with the National Fire Protection Association (NFPA) 72.
6. **Alternate fire-extinguishing systems for specialized areas.** When approved by the fire authority having jurisdiction, other types of approved automatic fire-extinguishing systems may be utilized as an alternate to sprinklers in the following areas: rare book rooms, central computer rooms and telecommunication rooms.
7. **Automatic sprinkler system plan requirement.** Fire sprinkler system drawings shall use the furniture plan as a background for coordination with furniture and book stack location and height.

## SECTION 440 GROUP C [SFM]

### 440.1 Group C Occupancies defined.

**440.1.1 Organized camps.** For the purposes of these regulations, Group C Occupancies shall mean “organized camps” as defined in Section 18897, Health and Safety Code.

**440.1.1.1 Description.** An organized camp is a site with programs and facilities established for the primary purpose of providing an outdoor group living experience with social, spiritual, educational or recreational objectives, for five days or more during one or more seasons of the year.

The term “organized camp” does not include a motel, tourist camp, trailer park, resort, hunting camp, auto court, labor camp, penal or correctional camp, child-care institution or home-finding agency nor does it include any charitable or recreational organization which complies with the rules and regulations for recreational trailer parks provided for by Section 18301 (b), Health and Safety Code.

**440.1.2 Tents and tent structures.** For the purpose of this chapter, a tent or tent structure is defined as any shelter of which 25 percent or more of the walls or roof, or both, are constructed of, or covered or protected by, a canvas or any other fabric material.

**440.2 Purpose and intent.** The provisions of this section are established to provide fire and life safety in organized camps, but at the same time preserve the basic concept of outdoor

living. It is the intent of this section that organized camps shall be considered as a separate and distinct occupancy.

### 440.3 Basic building and structures.

**440.3.1 Building classification.** Every building or structure shall be classified into the occupancy group they most nearly resemble and be constructed in accordance with appropriate occupancy requirements specified in this part.

#### Exceptions:

1. Tents, tent structures, and buildings and structures that do not exceed 25 feet (7620 mm) in any lateral dimension and where such building or structure is not more than one story.
2. For fire safety, buildings or structures on the premises of an organized camp which are used for sleeping purposes, regardless of their similarity to other occupancy groups, shall conform to the provisions of Sections 440.4, 440.5, 440.6 and 440.7.
3. For fire safety, buildings and structures which are not used for sleeping purposes shall conform to the provisions of Section 440.7, which shall supersede any similar provisions contained in this part.

**440.3.2 Occupant load.** The living shelter whether a building, structure, tent and tent structure, or cabin, shall provide a minimum of 30 square feet (2.8 m<sup>2</sup>) of superficial floor area per person for single-tier bed units, and 20 square feet (1.9 m<sup>2</sup>) of superficial floor area per person for two-tier bed units. More than two tiers per bed unit are prohibited. There shall be at least 3 feet (914 mm) of lateral distance between beds

**Exception:** Intermittent short-term organized camps are not required to provide shelter facilities but, if provided, they shall comply with this section.

### 440.4 General.

**440.4.1 Buildings intended for sleeping.** Buildings and structures used or intended for sleeping purposes which do not exceed any one of the limitations set forth below shall conform to the provisions of Sections 440.5 and 440.7.

1. One story in height
2. Twenty-five feet (7620 mm) in any lateral dimension

**Exception:** This provision shall not apply to buildings or structures conforming to construction provisions of this section in effect prior to January 1, 1985.

3. Maximum housing of 12 persons

**440.4.2 Limitations.** Buildings and structures used or intended for sleeping purposes, including those so used in whole or in part by staff personnel, and which exceed any one of the limitations set forth in Section 440.4.1, shall conform to the provisions of Sections 440.5 and 440.7.

**Exception:** Buildings or structures used exclusively for living and sleeping purposes by resident custodial or

caretaker personnel only may be constructed in accordance with the provisions of these regulations for a Group R, 3 Occupancy.

#### **440.5 Special buildings, tents and tent structures.**

**440.5.1 Special buildings.** In addition to the provisions of Section 440.7, special buildings conforming to the limitations specified in Section 440.4.1 shall conform to the following:

1. The flame-spread end-point rating of all interior finish materials shall not exceed 200.
2. Every room or area housing more than eight persons shall be provided with not less than two approved exits, each of which shall be direct to the exterior and shall not be less than 32 inches (813 mm) in clear width and 6 feet 8 inches (2032 mm) in height. Rooms or areas housing eight or less persons shall be provided with at least one such exit direct to the exterior.
3. Every exit door shall be openable from the inside without the use of any key, special knowledge or effort.
4. Exit doors need not be hung to swing in the direction of exit travel. Where exit doors are hung to swing in the direction of exit travel, a landing conforming to the provisions of Section 1008.1.5 shall be provided.
5. When the distance (measured vertically) between the ground level and the floor level exceeds 8 inches (203 mm), a stairway from each exit shall be provided. Steps shall have a rise of not more than 8 inches (203 mm) and a run of not less than 9 inches (229 mm). Such stairway shall be at least as wide as the door it serves.

**Exception:** In lieu of a stairway, a ramp having a slope of not more than 1 foot (305 mm) of rise for each 8 feet (2438 mm) of run may be provided.

6. When the floor level at any door opening of any building or structure is more than 30 inches (762 mm) above the adjacent ground level, handrails or guardrails shall be provided on the landing, balcony or porch, and on every stairway or ramp to ground level.
7. Buildings and structures or groups of buildings and structures shall be separated from each other by not less than 10 feet (3048 mm). This section shall not apply to existing buildings and structures of existing Group C Occupancies.

**440.5.2 Tents and tent structures.** In addition to the provisions of Section 440.7, tents and tent structures, or groups thereof, shall conform to the provisions of Section 440.5, except as follows:

1. Regardless of any other provisions of this section, heating of tents and tent structures shall be prohibited unless written permission is obtained from the fire chief.

2. All canvas or other fabric material shall be treated and maintained in a flame-retardant condition.

#### **Exceptions:**

1. Tents in existence prior to January 1, 1979, provided the following conditions are met:
  - 1.1. Tents shall not exceed 80 square feet (7.4 m<sup>2</sup>) in area.
  - 1.2. No electrical devices, except flashlights, are installed or used in the tents.
  - 1.3. Tents are not located closer than 30 feet (9144 mm) to any open fire.
  - 1.4. Smoking is prohibited in the tents.
  - 1.5. All other applicable provisions of this article are met.
2. Canvas or materials used exclusively to protect windows and similar openings in walls.
3. Canvas or materials used as a windbreak enclosure of not more than three sides and open to the sky.

**Note:** It is not the intent of Section 440.5.2 that strict adherence to the width and height requirements of exit openings be enforced for exits from tents.

**440.6 Building and structures for sleeping.** Buildings and structures, or portions thereof, used or intended for sleeping purposes and which exceed the height, area or capacity limitations specified in Section 440.4.1 shall conform to the provisions of this section.

**440.6.1 Area, height and type of construction.** Buildings and structures, or portions thereof, shall not exceed the limits of area, height and type of construction specified in these regulations for a Group R-2.1 occupancy. Such buildings and structures shall not be of less than one-hour fire-resistive construction throughout.

**440.6.2 Location on property.** The fire-resistive protection of exterior walls and openings, as determined by location on property, shall be in accordance with the provisions of these regulations for a Group R-2.1 occupancy.

**440.6.3 Exits.** Stairs, exits and smoke-proof enclosures shall be provided in accordance with the provisions of Chapter 10.

**440.6.4 Enclosure of vertical openings.** Exits shall be enclosed as specified in Chapter 10. Elevator shafts, vent shafts and other vertical openings shall be enclosed and enclosures shall be as set forth in Chapter 7.

**440.6.5 Fire-extinguishing systems.** Automatic fire-extinguishing systems, standpipes, and basement pipe inlets shall be installed when and as specified in Chapter 9 for buildings, based on the occupancy they most nearly resemble.

**440.6.6 Automatic fire alarm system.** See Section 907.

**440.7 Special requirements.** The provisions of this section shall apply to the premises and to all buildings and structures of all organized camps.

**440.7.1 Electrical.** The installation of all electrical wiring shall conform to the applicable provisions of the California Electrical Code.

**440.7.2 Heating equipment.** Heating equipment, and the installation thereof, shall conform to the provisions of the California Mechanical Code.

**440.7.3 Motion picture booths.** Motion picture machine booths shall conform to the requirements of Section 409.

**440.7.4 Interior finish.** Interior finish shall conform to the requirements of Chapter 8, except as permitted in Section 440.5.1, Item 1.

**440.7.5 Heater room openings.** All exterior openings in rooms containing central heating equipment, low-pressure boilers or water-heating boilers used as part of the heating system, if located below openings in another story, or if less than 10 feet (3048 mm) from other doors or windows of the same building, shall be protected by a fire assembly having a three-fourths-hour fire-resistive rating. Such fire assemblies shall be fixed, automatic or self-closing.

**Exception:** The requirement for three-fourths-hour fire assembly protection of openings may be deleted if the entire room is protected by an automatic sprinkler system conforming to the provisions of Section 903.

**440.7.6 Heating rooms.** Every room containing central-heating equipment, low-pressure boiler or water-heating boiler used as part of the heating system shall be separated from the rest of the building by a one-hour fire-resistive fire barrier with all openings protected as set forth in Section 707.6.

**Exceptions:**

1. Boilers or central heating plants where the largest piece of fuel equipment does not exceed 400,000 Btu per hour (135 kW) input.
2. When any such opening is protected by a pair of fire doors, the inactive leaf shall be normally secured in the closed position and shall be openable only by use of a tool. An astragal shall be provided and the active leaf shall be self-closing.

**440.7.7 Exits.** For purposes of determining occupant load for exit requirements, see Section 440.3.2.

**440.7.8 Liquefied petroleum gas.** The construction and installation of all tanks, cylinders, equipment and systems used or intended for use in conjunction with any liquefied petroleum gas shall conform to the provisions of the California Mechanical Code and the California Fire Code.

**440.7.9 Air-conditioning and ventilation systems.** Heating units used as an integral part of an air-conditioning and ventilation system shall be installed in accordance with Sections 440.7.2, 440.7.3 and 440.7.6.

**440.8 Camp fire alarm.** Every organized camp shall provide and maintain a device or devices suitable for sounding a fire

alarm. Such device or devices may be of any type acceptable to the enforcing agency provided they are distinctive in tone from all other signaling devices or systems and shall be audible throughout the camp premises. When an automatic fire alarm system is provided, as required by Section 440.6.6, all signaling devices required by this section shall be of the same type as that used in the automatic system.

## SECTION 441 RESERVED

## SECTION 442 SCHOOL FACILITIES FOR KINDERGARTEN THROUGH 12TH GRADE AND GROUP E DAY CARE

**442.1 General provisions.** School facilities for Kindergarten through 12th grade and Group E day care shall comply with the provisions of this section and other applicable provisions of this code including requirements for specific occupancies.

**442.1.1 Location on property.** All buildings housing Group E occupancies shall front directly on a public street or an exit discharge not less than 20 feet (6096 mm) in width. The exit discharge to the public street shall be a minimum 20-foot-wide (6096 mm) right-of-way, unobstructed and maintained only as access to the public street. At least one required exit shall be located on the public street or on the exit discharge.

**442.1.2 Separate means of egress systems required.** Every room with an occupant load of 300 or more shall have one of its exits or exit-access doorways lead directly into a separate means of egress system that consists of not less than two paths of exit travel which are separated by a smoke barrier in accordance with Section 710 in such a manner to provide an atmospheric separation that precludes contamination of both paths of exit travel by the same fire. Not more than two required exits or exit-access doorways shall enter into the same means of egress system.

**442.1.3 Fences and gates.** School grounds may be fenced and gates therein may be equipped with locks, provided that safe dispersal areas based on 3 square feet (0.28 m<sup>2</sup>) per occupant are located between the school and the fence. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from school buildings.

Every public and private school shall conform with Section 32020 of the Education Code which states:

The governing board of every public school district, and the governing authority of every private school, which maintains any building used for the instruction or housing of school pupils on land entirely enclosed (except for building walls) by fences of walls, shall, through cooperation with the local law enforcement and fire-protection agencies having jurisdiction of the area, make provision for the erection of gates in such fences or walls. The gates shall be of sufficient size to permit the entrance of the ambulances, police equipment and fire-fighting apparatus

used by the law enforcement and fire-protection agencies. There shall be no less than one such access gate and there shall be as many such gates as needed to assure access to all major buildings and ground areas. If such gates are to be equipped with locks, the locking devices shall be designed to permit ready entrance by the use of the chain or bolt-cutting devices with which the local law enforcement and fire-protection agencies may be equipped.

**442.1.4 Special provisions.** Rooms used by kindergarten, first-, or second-grade pupils, and Group E day care, shall not be located above or below the first story.

**Exceptions:**

1. Kindergarten, first-, or second-grade pupils, or day care may be located in basements or stories having floor levels located within 4 feet (1219 mm), measured vertically, from the adjacent ground level at the level of exit discharge, provided the basement or story has exterior exit doors at that level.
2. In buildings equipped with an automatic sprinkler system throughout, rooms used for kindergarten, first- and second-grade children or for day-care purposes may be located on the second story, provided there are at least two exterior exit doors, or other egress systems complying with Section 1018 with two exits, for the exclusive use of such occupants. Egress systems for the exclusive use of such occupants shall be maintained until exit discharge at grade is attained.
3. Group E day-care facilities may be located above the first story in buildings of Type I-A, Type I-B, Type II-A and III-A construction, subject to the limitation of Section 503 when:
  - 3.1. Facilities with children under the age of seven or containing more than 12 children per story shall not be located above the fourth floor; and
  - 3.2. The entire story in which the day-care facility is located is equipped with an approved manual fire alarm and smoke-detection system. Actuation of an initiating device shall sound an audible alarm throughout the entire story.
 

When a building fire alarm system is required by other provisions of this code, the alarm system shall be interconnected and sound the day-care fire alarm system; and
  - 3.3. The day-care facility, if more than 1,000 square feet (92.9 m<sup>2</sup>) in area, is divided into at least two compartments of approximately the same size by a smoke barrier in accordance with Section 710. In addition to the requirements of Section 508, occupancy separations between daycare and other occupancies shall be constructed as smoke barriers. Door openings in the smoke barrier

shall be tight fitting, with gaskets installed as required by Section 715.4.3.1 and shall be automatic closing by actuation of the fire sprinklers, fire alarm or smoke detection system; and

- 3.4. Each compartment formed by the smoke barrier has not less than two exits or exit-access doors, one of which is permitted to pass through the adjoining compartment, and
- 3.5. At least one exit or exit-access door from the day-care facility shall be into a separate means of egress with not less than two paths of exit travel, which are separated in such a manner to provide an atmospheric separation.
- 3.6. The building is equipped with an automatic sprinkler system throughout.

**442.1.5 Special hazards.** School classrooms constructed after January 1, 1990, not equipped with automatic sprinkler systems, which have metal grilles or bars on all their windows and do not have at least two exit doors within 3 feet (914 mm) of each end of the classroom opening to the exterior of the building or to a common hallway used for evacuation purposes, shall have an inside release for the grilles or bars on at least one window farthest from the exit doors. The window or windows with the inside release shall be clearly marked as emergency exits.

**442.1.6 Class I, II or III-A flammable liquids** shall not be placed, stored or used in Group E occupancies, except in approved quantities as necessary in laboratories and classrooms and for operation and maintenance as set forth in the California Fire Code.

## SECTION 443 GROUP L [SFM]

**443.1 Scope.** The provisions of this section shall apply to buildings or structures, or portions thereof, containing one or more Group L laboratory suites as defined in Section 443.2.

**443.2 Definitions.** The following terms are defined in Chapter 2:

**LABORATORY SUITE.**

**[F] LIQUID TIGHT FLOOR.**

**443.3 Laboratory suite requirements.**

**443.3.1** The gross square footage of an individual laboratory suite shall not exceed 10,000 sq ft (929 m<sup>2</sup>).

**443.3.2** An individual laboratory suite shall not serve more than a single tenant.

**Exception:** A laboratory suite controlled by a single responsible party.

**443.4 Construction**

**443.4.1 Separation of laboratory suites.**

**443.4.1.1** Laboratory suites shall be separated from other occupancies in accordance with Table 508.4.

**443.4.1.2** Laboratory suites shall be separated from other laboratory suites by a fire barrier having a fire-resistance rating of not less than 1-hour.

**443.4.1.3** Laboratory suites shall be separated from control areas by a minimum 2-hour fire-resistance rating in accordance with Sections 707 and 712.

**Exception:** Laboratory suites shall be separated from control areas by a minimum 1-hour fire-resistance rating on floor levels below the 4<sup>th</sup> story.

**443.4.1.4 Horizontal separation.** The floor construction of the laboratory suite and the construction supporting the floor of the laboratory suite shall have a minimum 2-hour fire-resistance rating in accordance with Section 712.

**Exceptions:**

1. The floor construction of the laboratory suite and the construction supporting the floor of the laboratory suite are allowed to be 1-hour fire-resistance rated in buildings of Type IIA, IIIA and VA construction.
2. When an individual laboratory suite occupies more than one story, the intermediate floors contained within the suite shall comply with the requirements of Table 601.

**443.4.2 Structural design occupancy category.**

**443.4.2.1** Buildings containing Group L occupancies with an occupant load greater than 500 for colleges or adult education facilities, or other buildings with an occupant load greater than 5,000 shall be classified as Occupancy Category III in accordance with Chapters 16 and 16A.

**443.4.2.2** Other buildings containing Group L occupancies shall be classified as Occupancy Category II in accordance with Chapters 16 and 16A.

**443.4.3 Fire barrier and fire-smoke barrier.**

**443.4.3.1 Fire barrier.** A fire barrier having a fire resistance rating of not less than 2-hours shall divide any story containing more than one laboratory suite above the 4<sup>th</sup> story.

**443.4.3.1.1** Fire barriers shall be continuous from exterior wall to exterior wall,

**443.4.3.1.2** The fire barrier shall divide the floor so that the square footage on each side of the 2-hour fire barrier is not less than 30 percent of the total floor area, and

**443.4.3.1.3** The number of laboratory suites on each side of the 2-hour fire barrier shall not be less than 25 percent of the total number of laboratory suites on the floor.

**443.4.3.2 Fire-smoke barrier.** Any story containing a Group L occupancy above the 10<sup>th</sup> story shall be subdivided by a fire-smoke barrier constructed as a fire barrier having a fire resistance rating of not less than 2-hours and shall also comply with the smoke barrier requirements of Section 710.

The 2-hour fire- smoke barrier shall be in accordance with Sections 443.4.3 through 443.4.3.2.3.

**443.4.3.2.1** A minimum of one door opening shall be provided in the 2-hour fire-smoke barrier for emergency access.

**443.4.3.2.2** Each side of the 2-hour fire- smoke barrier shall be designed as a separate smoke zone designed in accordance with Section 909.6.

**443.4.3.2.3** The area on each side of the 2-hour fire-smoke barrier shall be served by a minimum of one exit enclosure in accordance with Section 1022.

**443.4.4 Emergency response equipment area.** An area for emergency response equipment shall be provided on each floor in an approved location. The area shall be a minimum of 50 square feet (4.6 m<sup>2</sup>), accessed from outside the laboratory suite and identified with signage

**443.4.5 Liquid tight floor.** All portions of the laboratory suite where hazardous materials may be present shall be provided with a liquid tight floor. Where the floor is designed to provide spill control or secondary containment the floor shall be designed in accordance with California Fire Code Section 2704.2.

**443.4.6 Emergency power.** An emergency power system shall be provided in accordance with Chapter 27.

**443.4.6.1 Required systems.** Emergency power shall be provided for all electrically operated equipment, systems and connected control circuits including:

1. Mechanical ventilation systems. See Section 443.4.7.
2. Emergency alarm and monitoring systems.
3. Temperature control systems required to prevent unsafe process excursions or chemical reactions.
4. Treatment systems and scrubbers.
5. Egress lighting.
6. Electrically operated systems required elsewhere in this code and the California Fire Code.

**443.4.7 Ventilation.**

**443.4.7.1 Compatibility.** Incompatible materials shall not be conveyed in the same duct system. Combined products in mechanical exhaust ducts shall not create a physical hazard or reaction that could degrade the duct material. The building official may require a technical report in accordance with Section 443.7.1.

**443.4.7.2 Fire dampers, smoke dampers and combination fire/smoke dampers.** Fire dampers, smoke dampers or fire/smoke dampers shall not be permitted in product conveying and other mechanical exhaust duct systems used to maintain a safe laboratory environment. When the exhaust duct penetrates the laboratory suite boundary the exhaust duct shall be located within a horizontal assembly having a fire resistance rating equal to the fire barrier.

**443.4.7.3 Duct materials.** Product conveying and other mechanical exhaust duct systems used to maintain a

safe laboratory environment shall be constructed in accordance with Chapters 5 and 6 of the California Mechanical Code.

#### **443.4.7.4 Laboratory suite exhaust air.**

**443.4.7.4.1** Exhaust air from laboratory suites shall not be recirculated.

**443.4.7.4.2** Laboratory suite exhaust air shall be independently ducted to a point outside the building or a roof top structure.

##### **Exceptions:**

1. Exhaust ducts serving a single laboratory suite.
2. Exhaust ducts serving separate laboratory suites on the same story may be connected to a common duct within a fire rated vertical shaft when the sub-duct extends vertically upward at least 22 inches.
3. Exhaust ducts serving separate laboratory suites on the basement through the 4<sup>th</sup> story may be connected to a common duct within a fire rated vertical shaft when the sub-duct extends vertically upward at least 22 inches.
4. Exhaust ducts serving separate laboratory suites on the 5<sup>th</sup> story and above may be connected to a common duct that does not exceed 100 vertical feet within a fire rated vertical shaft when the subducts extends vertically upward at least 22 inches. Ducts serving the 5<sup>th</sup> story and above shall be separate from the duct serving the 4<sup>th</sup> story and below, but may be within the same fire rated shaft

**443.4.7.4.3** Laboratory suite exhaust ducts shall not penetrate the 2-hour fire barrier required by Section 443.4.3.

**Exception:** Where the exhaust duct is enclosed in a 2-hour shaft in accordance with Section 708.

**443.4.7.5 Ventilation rates.** Mechanical exhaust ventilation systems shall provide a minimum ventilation rate not less than 1 cubic feet per minute per square foot [ $0.00508 \text{ m}^3/(\text{s}\cdot\text{m}^2)$ ] of floor area, or 6 air exchanges per hour, whichever is greater. Systems shall operate continuously at the designed ventilation rate

**443.4.7.6 Mechanical ventilation systems on emergency power.** When operating on emergency power, the ventilation rate may be reduced to a level sufficient to maintain a differential pressure negative to the surrounding area.

**443.4.7.7 Mechanical ventilation system balancing.** Mechanical ventilation systems shall be designed and balanced such that during normal and emergency conditions the door opening forces comply with the requirements of Sections 1008.1.3 and Chapter 11B as

applicable. Emergency conditions shall include: supply fan shutdown or failure, closing of smoke dampers or combination fire/smoke dampers, or emergency power.

#### **443.5 Fire protection systems. See Chapter 9.**

#### **443.6 Means of egress.**

**443.6.1 Access to exits.** Every portion of a laboratory suite containing hazardous materials and having a floor area of 500 square feet ( $19 \text{ m}^2$ ) or more shall have access to not less than two separate exits or exit-access doorways in accordance with Section 1015.2.

**443.6.2 Door swing.** All exit and exit-access doors serving areas with hazardous materials shall swing in the direction of exit travel, regardless of the occupant load served.

**443.6.3 Panic hardware.** Exit and exit access doors from areas with hazardous materials shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware.

**443.6.4 Buildings more than four stories.** A minimum of one exit shall be provided to serve the floor on each side of the 2-hour fire barrier and shall comply with the provisions of Chapter 10.

**443.6.5 Corridors.** Corridors shall comply with Section 1018 and shall have opening protection in accordance with Tables 716.5 and 716.6.

#### **443.7 Hazardous materials.**

**443.7.1 Technical report.** The enforcing agency may require a technical opinion and report to identify and develop methods of protection from the hazards presented by the hazardous materials. A qualified person, firm or corporation, approved by the enforcing agency, shall prepare the opinion and report, and shall be provided without charge to the enforcing agency. The opinion and report may include, but is not limited to, the preparation of a hazardous material management plan (HMMP); chemical analysis; recommendations for methods of isolation, separation, containment or protection of hazardous materials or processes, including appropriate engineering controls to be applied; the extent of changes in the hazardous behavior to be anticipated under conditions of exposure to fire or from hazard control procedures; and the limitations or conditions of use necessary to achieve and maintain control of the hazardous materials or operations. The report shall be entered into the files of the code enforcement agencies. Proprietary and trade secret information shall be protected under the laws of the state or jurisdiction having authority.

**443.7.2 Multiple hazards.** When a hazardous material has multiple hazards, all hazards shall be addressed and controlled in accordance with the provisions of this code.

**443.7.3 Percentage of maximum allowable quantities.** The percentage of the maximum allowable quantity of hazardous materials per laboratory suite permitted for each story level within a building shall be in accordance with Table 443.7.3.1.



## SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

**TABLE 443.7.3.1  
HAZARDOUS MATERIALS QUANTITY PER LABORATORY SUITE**

STORY		PERCENTAGE OF MAXIMUM ALLOWABLE QUANTITY PER LABORATORY SUITE <sup>a, b</sup>	NUMBER OF LAB SUITES PER FLOOR BASED ON CONSTRUCTION TYPE				
			Type IA	Type IB	Type IIA, IIIA, IV	Type IIB, IIIB, VA	Type VB
Above grade plane	Above 20	0	NP	NP	NP	NP	NP
	15 to 20	25	4	NP	NP	NP	NP
	11, 12, 13, 14	50	8	NP	NP	NP	NP
	7, 8, 9, 10	50	16	NP	NP	NP	NP
	6	75	20	20	NP	NP	NP
	4, 5	75	20	20	20	NP	NP
	3	100	UL	UL	UL	UL	NP
	1, 2	100	UL	UL	UL	UL	UL
Below grade plane	1	75 <sup>c</sup>	10	10	10	10	10
	2	50 <sup>d</sup>	5	5	5	5	5
	3 and below	0	NP	NP	NP	NP	NP

UL = Unlimited, NP= Not permitted

- Percentages shall be of the maximum allowable quantity per laboratory suite shown in Tables 307.1(1) and 307.1(2). Allowable hazardous material increases for buildings equipped throughout with an automatic sprinkler system shall not be applicable to Group L occupancies.
- When an individual laboratory suite occupies more than one story, the more restrictive percentage of the maximum allowable quantity per laboratory suite shall apply.
- The total aggregate quantity of flammable liquids on the first story below grade shall be limited to the maximum total aggregate quantity for Group B occupancy control areas.
- The total aggregate quantity of flammable liquids on the second story level below grade shall be limited to a maximum total aggregate quantity for Group B occupancy control areas.

**443.7.4 Handling and transportation.** The handling and transportation of hazardous materials shall be in accordance with Section 2703 of the California Fire Code.

**443.7.5 Transportation of hazardous materials above the 10<sup>th</sup> story.** Transportation of hazardous materials above the 10<sup>th</sup> story shall be limited to 5 percent of the maximum allowable quantities of Tables 307.1 (1) and 307.1(2.) Quantities are permitted to be increased 100 percent in buildings with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Materials where footnote g of Table 307.1(1) applies shall not be increased.

**443.8. Elevators and elevator lobbies above the 10<sup>th</sup> story.** Any story containing a Group L occupancy above the 10<sup>th</sup> story shall be provided with elevators and elevator lobbies in accordance with Sections 443.8.1 through 443.8.3.

**443.8.1** An elevator that serves every story of the building shall be provided on each side of the 2-hour fire-smoke barrier.

**443.8.2** An elevator lobby shall be provided on each side of the 2-hour fire-smoke barrier at each floor in accordance with Section 708.14.1. Exceptions to 708.14.1 shall not apply.

**443.8.3** The elevator and its associated elevator lobbies and elevator machine rooms shall be pressurized in accordance with Section 909.6.

**443.9** Existing Group L (Formerly Group H-8) occupancies, additions, alterations, or repairs. See Section 3416.

### SECTION 444 Reserved

### SECTION 445 LARGE FAMILY DAY-CARE HOMES [SFM]

**445.1** Large family day-care homes.

**445.2** For purposes of clarification, Health and Safety Code Section 1597.46 is repeated.

(a) A city, county, or city and county shall not prohibit large family day care homes on lots zoned for single-family dwellings, but shall do one of the following:

(1) Classify these homes as a permitted use of residential property for zoning purposes.

(2) Grant a nondiscretionary permit to use a lot zoned for a single-family dwelling to any large family day-care home that complies with local ordinances prescribing reasonable standards, restrictions and requirements concerning spacing and concentration, traffic control, parking and noise control relating to such homes, and complies with subdivision (d) and any regulations adopted by the state fire marshal pursuant to that subdivision. Any noise standards shall be consistent with local noise ordinances implementing the noise element of the general plan and shall take into consideration the noise level generated by children. The permit issued pursuant to this paragraph shall be granted by the zoning administrator, if any, or if there is no zoning administrator by the person or persons designated by the planning agency to grant such permits, upon the certification without a hearing.

(3) Require any large family day-care home to apply for a permit to use a lot zoned for single-family dwellings. The zoning administrator, if any, or if there is no zoning administrator, the person or persons designated by the planning agency to handle the use permits shall review and decide the applications. The use permit shall be granted if the large family day care home complies with local ordinances, if any, prescribing reasonable standards, restrictions and requirements concerning spacing and concentration, traffic control, parking and noise control relating to such homes, and complies with subdivision (d) and any regulations adopted by the state fire marshal pursuant to that subdivision.

Any noise standards shall be consistent with local noise ordinances implementing the noise element of the general plan and shall take into consideration the noise levels generated by children.

*The local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process. Not less than 10 days prior to the date on which the decision will be made on the application, the zoning administrator or person designated to handle such use permits shall give notice of the proposed use by mail or delivery to all owners shown on the last equalized assessment roll as owning real property within a 100-foot radius of the exterior boundaries of the proposed large family day care home. No hearing on the application for a permit issued pursuant to this paragraph shall be held before a decision is made unless a hearing is requested by the applicant or other affected person. The applicant or other affected person may appeal the decision. The appellant shall pay the cost, if any of the appeal.*

*(b) A large family day-care home shall not be subject to the provisions of Division 13 (commencing with Section 21000) of the Public Resources Code.*

*(c) Use of a single-family dwelling for the purposes of a large family day-care home shall not constitute a change of occupancy for purposes of Part 1.5 (commencing with Section 17910) of Division 13 (State Housing Law), or for purposes of local building and fire codes.*

*(d) Large family day-care homes shall be considered as single-family residences for the purposes of the State Uniform Building Standards Code and local building and fire codes, except with respect to any additional standards specifically designed to promote the fire and life safety of the children in these homes adopted by the State Fire Marshal pursuant to this subdivision.*

**445.3 Smoke alarms.** *Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms. The number and placement of smoke alarms shall be determined by the enforcement authority.*

**445.4 Fire extinguishers.** *Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2A10BC rating.*

**445.5 Fire alarm devices.** *See Section 907.2.6.4.*

**445.6 Compliance.** *Every large-family day-care home shall comply with the provisions for Group R-3 occupancies and, if appropriate, Section 426.1. For the purposes of Section 426.1, the first story shall be designated as the floor used for residential occupancy nearest to the street level which provides primary access to the building.*

*Enforcement of the provisions shall be in accordance with the Health and Safety Code Sections 13145 and 13146. No city, county, city and county, or district shall adopt or enforce any building ordinance or local rule or regulation relating to the subject of fire and life safety in large-family day-care homes which is inconsistent with those standards adopted by the State Fire Marshal, except to the extent the building ordinance or local rule or regulation applies to single-family residences in which day care is not provided.*

**445.7 Special hazards.** *Every unenclosed gas-fired water heater or furnace which is within the area used for child care in a large family day-care home shall be protected in such a way as to prevent children from making contact with those appliances.*

**Exception:** *This does not apply to kitchen stoves or ovens.*

**445.8 Exiting.** *See Section 1015.7.*

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 5 – GENERAL BUILDING HEIGHTS AND AREAS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X	X	X		X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X																
<i>Adopt only those sections that are listed below</i>						X									X			X		
<i>Chapter / Section</i>																				
Table 503		X																		
503.1			X																	
504.2																				
506.3		X																		
506.4.1		X																		
506.5.2		X																		
507.3		X																		
507.10		X																		
508.2.4		X																		
Table 508.2.5		X																		
508.3.3		X																		
Table 508.4		X																		
509.2		X																		
510.10		X																		



## CHAPTER 5

# GENERAL BUILDING HEIGHTS AND AREAS

### SECTION 501 GENERAL

**501.1 Scope.** The provisions of this chapter control the height and area of structures hereafter erected and additions to existing structures.

**[F] 501.2 Address identification.** New and existing buildings shall be provided with approved address numbers or letters. Each character shall be not less than 4 inches (102 mm) in height and not less than 0.5 inch (12.7 mm) in width. They shall be installed on a contrasting background and be plainly visible from the street or road fronting the property. When required by the fire code official, address numbers shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other approved sign or means shall be used to identify the structure. Address numbers shall be maintained.

### SECTION 502 DEFINITIONS

**502.1 Definitions.** The following terms are defined in Chapter 2:

**AREA, BUILDING.**

**BASEMENT.**

**EQUIPMENT PLATFORM.**

**GRADE PLANE.**

**HEIGHT, BUILDING.**

**MEZZANINE.**

### SECTION 503 GENERAL BUILDING HEIGHT AND AREA LIMITATIONS

**503.1 General.** The building height and area shall not exceed the limits specified in Table 503 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. Each portion of a building separated by one or more fire walls complying with Section 706 shall be considered to be a separate building.

#### **Exceptions:**

1. *[HCD 1] Limited-density owner-built rural dwellings may be of any type of construction which will provide for a sound structural condition. Structural hazards which result in an unsound condition and which may constitute a substandard building are delineated by Section 17920.3 of the Health and Safety Code.*

2. *Other than structural requirements, solar photovoltaic panels supported by a structure with no use underneath shall not constitute additional story or additional floor area and may exceed the height limit when constructed on a roof top of a building provided the following conditions are met:*

1.1. *For all occupancies, the highest point of the structure/panel shall meet the lower of the two values below:*

1. *3' above the allowable building height per this code.*
2. *3' above the roof of the building immediately below.*

2.1. *For installations on flat roofs in other than Group R-3 and R-4 occupancies, the highest point of the structure/panel shall meet the lower of the two values below:*

1. *10' above the allowable building height per this code.*
2. *10' above the roof of the building immediately below.*

3. *Other than structural requirements, solar photovoltaic panels supported by a structure over parking stalls shall not constitute additional story or additional floor area and may exceed the height limit as specified in exception 2 (above) when the following conditions are met (see Figure 5-1):*

1. *The area within the perimeter of the photovoltaic array has maximum rectangular dimension of 40 feet by 150 feet.*
2. *The distance between solar photovoltaic array structures is a minimum of 10 feet clear.*
3. *The driveway aisle separating solar photovoltaic array structures has a minimum width of 25 feet clear.*
4. *Solar photovoltaic array structure is used only for parking purposes with no storage.*
5. *Completely open on all sides (other than necessary structural supports) with no interior partitions.*

**503.1.1 Special industrial occupancies.** Buildings and structures designed to house special industrial processes that require large areas and unusual building heights to accommodate craneways or special machinery and equipment, including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be

## GENERAL BUILDING HEIGHTS AND AREAS

exempt from the building height and area limitations of Table 503.

**503.1.2 Buildings on same lot.** Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building if the building height of each building and the aggregate building area of the buildings are within the limitations of Table 503 as modified by Sections 504 and 506. The provisions of this code applicable to the aggregate building shall be applicable to each building.

**503.1.3 Type I construction.** Buildings of Type I construction permitted to be of unlimited tabular building heights and areas are not subject to the special requirements that allow unlimited area buildings in Section 507 or unlimited building height in Sections 503.1.1 and 504.3 or increased building heights and areas for other types of construction.

**TABLE 503**  
**ALLOWABLE BUILDING HEIGHTS AND AREAS<sup>a, b</sup>**  
Building height limitations shown in feet above grade plane. Story limitations shown as stories above grade plane.  
Building area limitations shown in square feet, as determined by the definition of "Area, building," per story

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT (feet)	UL	160	65	55	65	55	65	50	40
STORIES(S) AREA (A)										
A-1	S A	UL UL	5 UL	3 15,500	2 8,500	3 14,000	2 8,500	3 15,000	2 11,500	1 5,500
A-2	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-3	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-4	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL
B	S A	UL UL	11 UL	5 37,500	3 23,000	5 28,500	3 19,000	5 36,000	3 18,000	2 9,000
E	S A	UL UL	5 UL	3 26,500	2 14,500	3 23,500	2 14,500	3 25,500	1 18,500	1 9,500
F-1	S A	UL UL	11 UL	4 25,000	2 15,500	3 19,000	2 12,000	4 33,500	2 14,000	1 8,500
F-2	S A	UL UL	11 UL	5 37,500	3 23,000	4 28,500	3 18,000	5 50,500	3 21,000	2 13,000
H-1	S A	1 21,000	1 16,500	1 11,000	1 7,000	1 9,500	1 7,000	1 10,500	1 7,500	NP NP
H-2	S A	20 21,000	3 16,500	2 11,000	1 7,000	2 9,500	1 7,000	2 10,500	1 7,500	1 3,000
H-3	S A	20 UL	6 60,000	4 26,500	2 14,000	4 17,500	2 13,000	4 25,500	2 10,000	1 5,000
H-4	S A	20 UL	7 UL	5 37,500	3 17,500	5 28,500	3 17,500	5 36,000	3 18,000	2 6,500
H-5	S A	4 UL	4 UL	3 37,500	3 23,000	3 28,500	3 19,000	3 36,000	3 18,000	2 9,000
I-2/I-2.1 <sup>d</sup>	S A	UL UL	4 UL	2 15,000	1 11,000	1 12,000	NP NP	1 12,000	1 9,500	NP NP
I-3 <sup>c</sup>	S A	UL UL	2 15,100	NP NP	NP NP	NP NP	NP NP	NP NP	NP NP	NP NP
I-4	S A	UL UL	5 60,500	3 26,500	2 13,000	3 23,500	2 13,000	3 25,500	1 18,500	1 9,000
L	S A	20 UL	6 60,000	5 37,500	3 17,500	5 28,500	3 17,500	5 36,000	3 18,000	2 6,500
M	S A	UL UL	11 UL	4 21,500	2 12,500	4 18,500	2 12,500	4 20,500	3 14,000	1 9,000
R-1	S A	UL UL	11 UL	4 24,000	4 16,000	4 24,000	4 16,000	4 20,500	3 12,000	2 7,000

(continued)

**TABLE 503—continued**  
**ALLOWABLE BUILDING HEIGHTS AND AREAS<sup>a, b</sup>**

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT (feet)	UL	160	65	55	65	55	65	50	40
STORIES(S) AREA (A)										
R-2	S A	UL UL	11 UL	4 24,000	4 16,000	4 24,000	4 16,000	4 20,500	3 12,000	2 7,000
R-2.1	S A	UL UL	6 <sup>f</sup> 55,000	3 <sup>e</sup> 19,000	NP NP	3 <sup>e</sup> 16,500	NP NP	NP NP	3 <sup>e</sup> 16,500	NP NP
R-3/R-3.1	S A	UL UL	11 UL	4 UL	4 UL	4 UL	4 UL	4 UL	3 UL	3 UL
R-4	S A	UL UL	11 <sup>f</sup> UL	4 <sup>e</sup> 24,000	4 <sup>g</sup> 16,000	4 <sup>e</sup> 24,000	4 <sup>g</sup> 16,000	4 <sup>g</sup> 20,500	3 <sup>e</sup> 12,000	2 <sup>g</sup> 7,000
S-1	S A	UL UL	11 48,000	4 26,000	2 17,500	3 26,000	2 17,500	4 25,500	3 14,000	1 9,000
S-2	S A	UL UL	11 79,000	5 39,000	3 26,000	4 39,000	3 26,000	5 38,500	4 21,000	2 13,500
U <sup>c</sup>	S A	UL UL	5 35,500	4 19,000	2 8,500	3 14,000	2 8,500	4 18,000	2 9,000	1 5,500

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

A = building area per story, S = stories above grade plane, UL = Unlimited, NP = Not permitted.

a. See the following sections for general exceptions to Table 503:

1. Section 504.2, Allowable building height and story increase due to automatic sprinkler system installation.
2. Section 506.2, Allowable building area increase due to street frontage.
3. Section 506.3, Allowable building area increase due to automatic sprinkler system installation.
4. Section 507, Unlimited area buildings.

b. See Chapter 4 for specific exceptions to the allowable height and areas in Chapter 5.

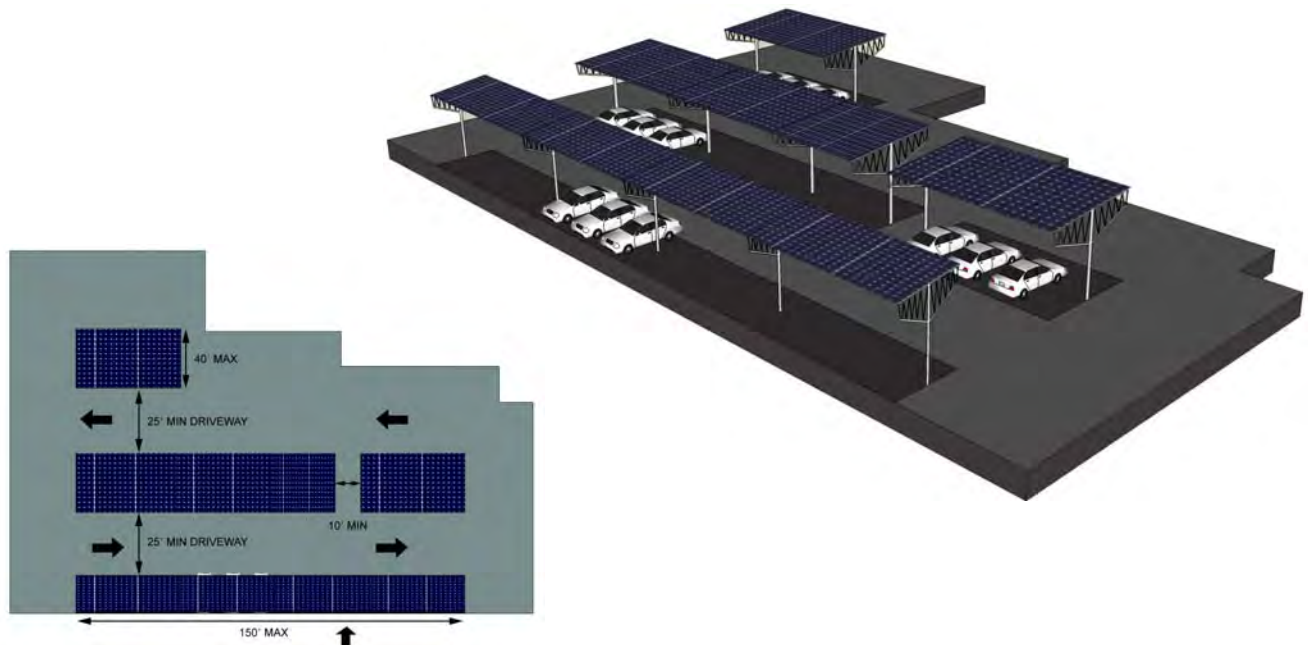
c. See Section 408.1.2 for specific exceptions to construction type, allowable building areas and allowable heights.

d. Restraint shall not be permitted in any building except in Group I-3 occupancies constructed for such use (see Section 408.1.2).

e. Nonambulatory persons shall be limited to the first 2 stories.

f. Nonambulatory persons shall be limited to the first 5 stories.

g. Nonambulatory elderly clients are not permitted in buildings of these types of construction. See Section 425.3.3 and 425.3.4.



**FIGURE 5-1**

## SECTION 504 BUILDING HEIGHT

**504.1 General.** The building height permitted by Table 503 shall be increased in accordance with Sections 504.2 and 504.3.

**Exception:** The building height of one-story aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited if the building is provided with an automatic sprinkler system or automatic fire-extinguishing system in accordance with Chapter 9 and is entirely surrounded by public ways or yards not less in width than one and one-half times the building height.

**504.2 Automatic sprinkler system increase.** Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the value specified in Table 503 for maximum building height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one. Increases are permitted in addition to the building area increase in accordance with Section 506.2. *In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, these increases are permitted in addition to the area increase in accordance with Section 506.3.* For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the value specified in Table 503 for maximum building height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one, but shall not exceed 60 feet (18 288 mm) or four stories, respectively, *these increases are permitted in addition to the area increase in accordance with Section 506.3.*

**Exception:** The use of an automatic sprinkler system to increase building heights shall not be permitted for the following conditions:

1. Buildings, or portions of buildings, classified as a Group I-2 occupancy of Type IIB, III, IV or V construction.
2. Buildings, or portions of buildings, classified as a Group H-1, H-2, H-3 or H-5 occupancy.
3. Buildings where an automatic sprinkler system is substituted for fire-resistance rated construction in accordance with Table 601, Note d.
4. [SFM] Buildings, or portions of buildings, classified as a Group L occupancy.
5. [SFM] Buildings, or portions of buildings, classified as a Licensed Group R-2.1 or R-4 occupancy.

**504.3 Roof structures.** Towers, spires, steeples and other roof structures shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by Section 1509.2.5. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height if of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable building height if of combustible materials (see Chapter 15 for additional requirements).

## SECTION 505 MEZZANINES AND EQUIPMENT PLATFORMS

**505.1 General.** Mezzanines shall comply with Section 505.2. Equipment platforms shall comply with Section 505.3.

**505.2 Mezzanines.** A mezzanine or mezzanines in compliance with Section 505.2 shall be considered a portion of the story below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by Section 503.1. The area of the mezzanine shall be included in determining the fire area. The clear height above and below the mezzanine floor construction shall be not less than 7 feet (2134 mm).

**505.2.1 Area limitation.** The aggregate area of a mezzanine or mezzanines within a room shall be not greater than one-third of the floor area of that room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the mezzanine is located. In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the floor area of the room.

Where a room contains both a mezzanine and an equipment platform, the aggregate area of the two raised floor levels shall be not greater than two-thirds of the floor area of that room or space in which they are located.

### Exceptions:

1. The aggregate area of mezzanines in buildings and structures of Type I or II construction for special industrial occupancies in accordance with Section 503.1.1 shall be not greater than two-thirds of the floor area of the room.
2. The aggregate area of mezzanines in buildings and structures of Type I or II construction shall be not greater than one-half of the floor area of the room in buildings and structures equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 and an approved emergency voice/alarm communication system in accordance with Section 907.5.2.2.

**505.2.2 Means of egress.** The means of egress for mezzanines shall comply with the applicable provisions of Chapter 10.

**505.2.3 Openness.** A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches (1067 mm) in height, columns and posts.

### Exceptions:

1. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the occupant load of the aggregate area of the enclosed space is not greater than 10.
2. A mezzanine having two or more means of egress is not required to be open to the room in which the mezzanine is located if at least one of the



means of egress provides direct access to an exit from the mezzanine level.

3. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the mezzanine area.
4. In industrial facilities, mezzanines used for control equipment are permitted to be glazed on all sides.
5. In occupancies other than Groups H and I, that are no more than two stories above grade plane and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a mezzanine having two or more means of egress shall not be required to be open to the room in which the mezzanine is located.

**505.3 Equipment platforms.** Equipment platforms in buildings shall not be considered as a portion of the floor below. Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by Section 503.1. The area of the equipment platform shall not be included in determining the fire area in accordance with Section 903. Equipment platforms shall not be a part of any mezzanine and such platforms and the walkways, stairs, alternating tread devices and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.

**505.3.1 Area limitation.** The aggregate area of all equipment platforms within a room shall be not greater than two-thirds of the area of the room in which they are located. Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by Section 505.2.1 and the combined aggregate area of the equipment platforms and mezzanines shall be not greater than two-thirds of the room in which they are located.

**505.3.2 Automatic sprinkler system.** Where located in a building that is required to be protected by an automatic sprinkler system, equipment platforms shall be fully protected by sprinklers above and below the platform, where required by the standards referenced in Section 903.3.

**505.3.3 Guards.** Equipment platforms shall have guards where required by Section 1013.2.

## SECTION 506 BUILDING AREA MODIFICATIONS

**506.1 General.** The building areas limited by Table 503 shall be permitted to be increased due to frontage ( $I_f$ ) and automatic sprinkler system protection ( $I_s$ ) in accordance with Equation 5-1:

$$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\} \quad \text{(Equation 5-1)}$$

where:

$A_a$  = Allowable building area per story (square feet).

$A_t$  = Tabular building area per story in accordance with Table 503 (square feet).

$I_f$  = Area increase factor due to frontage as calculated in accordance with Section 506.2.

$I_s$  = Area increase factor due to sprinkler protection as calculated in accordance with Section 506.3.

**506.2 Frontage increase.** Every building shall adjoin or have access to a public way to receive a building area increase for frontage. Where a building has more than 25 percent of its perimeter on a public way or open space having a width of not less than 20 feet (6096 mm), the frontage increase shall be determined in accordance with Equation 5-2:

$$I_f = [F/P - 0.25]W/30 \quad \text{(Equation 5-2)}$$

where:

$I_f$  = Area increase due to frontage.

$F$  = Building perimeter that fronts on a public way or open space having 20 feet (6096 mm) open minimum width (feet).

$P$  = Perimeter of entire building (feet).

$W$  = Width of public way or open space (feet) in accordance with Section 506.2.1.

**506.2.1 Width limits.** To apply this section the value of  $W$  shall be not less than 20 feet (6096 mm). Where the value of  $W$  varies along the perimeter of the building, the calculation performed in accordance with Equation 5-2 shall be based on the weighted average calculated in accordance with Equation 5-3 for portions of the exterior perimeter walls where the value of  $W$  is greater than or equal to 20 feet (6096 mm). Where the value of  $W$  is greater than 30 feet (9144 mm), a value of 30 feet (9144 mm) shall be used in calculating the weighted average, regardless of the actual width of the open space.  $W$  shall be measured perpendicular from the face of the building to the closest interior lot line. Where the building fronts on a public way, the entire width of the public way shall be used. Where two or more buildings are on the same lot,  $W$  shall be measured from the exterior face of each building to the opposing exterior face of each adjacent building, as applicable.

$$\text{Weighted average } W = (L_1 \times w_1 + L_2 \times w_2 + L_3 \times w_3 \dots) / F. \quad \text{(Equation 5-3)}$$

where:

$L_n$  = Length of a portion of the exterior perimeter wall.

$w_n$  = Width of open space associated with that portion of the exterior perimeter wall.

$F$  = Building perimeter that fronts on a public way or open space having a width of 20 feet (6096 mm) or more.

**Exception:** Where the building meets the requirements of Section 507, as applicable, except for compliance with the 60-foot (18 288 mm) public way or yard requirement, and the value of  $W$  is greater than 30 feet (9144 mm), the value of  $W$  divided by 30 shall be limited to a maximum of 2.

**506.2.2 Open space limits.** Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved fire lane.

**506.3 Automatic sprinkler system increase.** Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the building area limitation in Table 503 is permitted to be increased by an additional 200 percent ( $I_s = 2$ ) for buildings with more than one story above grade plane and an additional 300 percent ( $I_s = 3$ ) for buildings with no more than one story above grade plane. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, these increases are permitted in addition to the height and story increases in accordance with Section 504.2. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, these increases are permitted in addition to the height and story increase in accordance with Section 504.2.

**Exception:** The use of an automatic sprinkler system to increase the building area limitation shall not be permitted for the following conditions:

1. Buildings classified as a Group H-1 occupancy.
2. Buildings, or portions of buildings, classified as either a Group H-2 or H-3 occupancy. For buildings containing such occupancies, the allowable area shall be determined in accordance with Section 508.4.2, with the sprinkler system increase applicable only to the portions of the building not classified as Group H-2 or H-3.
3. Buildings where an automatic sprinkler system is substituted for fire-resistance rated construction in accordance with Table 601, Note d.
4. [SFM] The automatic sprinkler system increase shall not apply to buildings with an occupancy in Group L.

**506.4 Single occupancy buildings with more than one story.** The total allowable building area of a single occupancy building with more than one story above grade plane shall be determined in accordance with this section. The actual aggregate building area at all stories in the building shall not exceed the total allowable building area.

**Exception:** A single basement need not be included in the total allowable building area, provided such basement does not exceed the area permitted for a building with no more than one story above grade plane.

**506.4.1 Area determination.** In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the total allowable building area of a single occupancy building with more than one story above grade plane shall be determined by multiplying the allowable building area per story ( $A_a$ ), as determined in Section 506.1, by the number of stories above grade plane as listed below:

1. For buildings with two stories above grade plane, multiply by 2;
2. For buildings with three or more stories above grade plane, multiply by 3; and
3. No story shall exceed the allowable building area per story ( $A_a$ ), as determined in Section 506.1, for the occupancies on that story.

**Exception:** Unlimited area buildings in accordance with Section 507.

For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the total allowable building area of a single occupancy building with more than one story above grade plane shall be determined by multiplying the allowable building area per story ( $A_a$ ), as determined in Section 506.1, by the number of stories above grade plane as listed below:

1. For buildings with two or more stories above grade plane, multiply by 2;
2. No story shall exceed the allowable building area per story ( $A_a$ ), as determined in Section 506.1, for the occupancies on that story.

**Exception:** Unlimited area buildings in accordance with Section 507.

**506.5 Mixed occupancy area determination.** The total allowable building area for buildings containing mixed occupancies shall be determined in accordance with the applicable provisions of this section. A single basement need not be included in the total allowable building area, provided such basement does not exceed the area permitted for a building with no more than one story above grade plane.

**506.5.1 No more than one story above grade plane.** For buildings with no more than one story above grade plane and containing mixed occupancies, the total building area shall be determined in accordance with the applicable provisions of Section 508.1.

**506.5.2 More than one story above grade plane.** For buildings with more than one story above grade plane and containing mixed occupancies, each story shall individually comply with the applicable requirements of Section 508.1. For buildings with more than three stories above grade plane, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories based on the applicable provisions of Section 508.1 shall not exceed 3.

For other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, buildings with more than three stories above grade plane, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories based on the applicable provisions of Section 508.1 shall not exceed 3.

For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11

*regulated by the Office of the State Fire Marshal, buildings with more than two stories above grade plane, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories based on the applicable provisions of Section 508.1 shall not exceed 2.*

## SECTION 507 UNLIMITED AREA BUILDINGS

**507.1 General.** The area of buildings of the occupancies and configurations specified in Sections 507.1 through 507.12 shall not be limited.

**Exception:** Other occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2.

Where Sections 507.2 through 507.12 require buildings to be surrounded and adjoined by public ways and yards, those open spaces shall be determined as follows:

1. Yards shall be measured from the building perimeter in all directions to the closest interior lot lines or to the exterior face of an opposing building located on the same lot, as applicable.
2. Where the building fronts on a public way, the entire width of the public way shall be used.

**507.2 Nonsprinklered, one story.** The area of a Group F-2 or S-2 building no more than one story in height shall not be limited where the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**507.3 Sprinklered, one story.** The area of a Group B, F, M or S building no more than one story above grade plane of any construction type, shall not be limited where the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**Exception:** Buildings and structures of Types I and II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.3 and 903.3.1.1 and Chapter 32 of the *California Fire Code*.

**507.3.1 Mixed occupancy buildings with Groups A-1 and A-2.** Group A-1 and A-2 occupancies of other than Type V construction shall be permitted within mixed occupancy buildings of unlimited area complying with Section 507.3, provided:

1. Group A-1 and A-2 occupancies are separated from other occupancies as required for separated occupancies in Section 508.4.4 with no reduction allowed in the fire-resistance rating of the separation based upon the installation of an automatic sprinkler system;
2. Each area of the portions of the building used for Group A-1 or A-2 occupancies shall not exceed the

maximum allowable area permitted for such occupancies in Section 503.1; and

3. Exit doors from Group A-1 and A-2 occupancies shall discharge directly to the exterior of the building.

**507.4 Two story.** The area of a Group B, F, M or S building no more than two stories above grade plane shall not be limited where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**507.5 Reduced open space.** The public ways or yards of 60 feet (18 288 mm) in width required in Sections 507.2, 507.3, 507.4, 507.6 and 507.11 shall be permitted to be reduced to not less than 40 feet (12 192 mm) in width provided all of the following requirements are met:

1. The reduced width shall not be allowed for more than 75 percent of the perimeter of the building.
2. The exterior walls facing the reduced width shall have a fire-resistance rating of not less than 3 hours.
3. Openings in the exterior walls facing the reduced width shall have opening protectives with a fire protection rating of not less than 3 hours.

**507.6 Group A-3 buildings of Type II construction.** The area of a Group A-3 building no more than one story above grade plane, used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type II construction, shall not be limited provided all of the following criteria are met:

1. The building shall not have a stage other than a platform.
2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**507.7 Group A-3 buildings of Types III and IV construction.** The area of a Group A-3 building of Type III or IV construction, with no more than one story above grade plane, and used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court, shall not be limited provided all of the following criteria are met:

1. The building shall not have a stage other than a platform.
2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The assembly floor shall be located at or within 21 inches (533 mm) of street or grade level and all exits are provided with ramps complying with Section 1010.1 to the street or grade level.

4. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**507.8 Group H occupancies.** Group H-2, H-3 and H-4 occupancies shall be permitted in unlimited area buildings containing Group F and S occupancies in accordance with Sections 507.3 and 507.4 and the provisions of Sections 507.8.1 through 507.8.4.

**507.8.1 Allowable area.** The aggregate floor area of Group H occupancies located in an unlimited area building shall not exceed 10 percent of the area of the building nor the area limitations for the Group H occupancies as specified in Table 503 as modified by Section 506.2 based upon the perimeter of each Group H floor area that fronts on a public way or open space.

**507.8.1.1 Located within the building.** The aggregate floor area of Group H occupancies not located at the perimeter of the building shall not exceed 25 percent of the area limitations for the Group H occupancies as specified in Table 503.

**507.8.1.1.1 Liquid use, dispensing and mixing rooms.** Liquid use, dispensing and mixing rooms having a floor area of not more than 500 square feet (46.5 m<sup>2</sup>) need not be located on the outer perimeter of the building where they are in accordance with the *California Fire Code* and NFPA 30.

**507.8.1.1.2 Liquid storage rooms.** Liquid storage rooms having a floor area of not more than 1,000 square feet (93 m<sup>2</sup>) need not be located on the outer perimeter where they are in accordance with the *California Fire Code* and NFPA 30.

**507.8.1.1.3 Spray paint booths.** Spray paint booths that comply with the *California Fire Code* need not be located on the outer perimeter.

**507.8.2 Located on building perimeter.** Except as provided for in Section 507.8.1.1, Group H occupancies shall be located on the perimeter of the building. In Group H-2 and H-3 occupancies, not less than 25 percent of the perimeter of such occupancies shall be an exterior wall.

**507.8.3 Occupancy separations.** Group H occupancies shall be separated from the remainder of the unlimited area building and from each other in accordance with Table 508.4.

**507.8.4 Height limitations.** For two-story unlimited area buildings, Group H occupancies shall not be located more than one story above grade plane unless permitted based on the allowable height in stories and feet as set forth in Table 503 for the type of construction of the unlimited area building.

**507.9 Aircraft paint hangar.** The area of a Group H-2 aircraft paint hangar no more than one story above grade plane shall not be limited where such aircraft paint hangar complies with the provisions of Section 412.6 and is surrounded and adjoined by public ways or yards not less in width than one and one-half times the building height.

**507.10 Group E buildings.** The area of a Group E building no more than one story above grade plane, of Type II, IIIA or IV construction, shall not be limited provided all of the following criteria are met:

1. Each classroom shall have not less than two means of egress, with one of the means of egress being a direct exit to the outside of the building complying with Section 1020.
2. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**507.11 Motion picture theaters.** In buildings of Type II construction, the area of a motion picture theater located on the first story above grade plane shall not be limited provided the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**507.12 Covered and open mall buildings and anchor buildings.** The area of covered and open mall buildings and anchor buildings not exceeding three stories in height that comply with Section 402 shall not be limited.

## SECTION 508 MIXED USE AND OCCUPANCY

**508.1 General.** Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3 or 508.4, or a combination of these sections.

### Exceptions:

1. Occupancies separated in accordance with Section 510.
2. Where required by Table 415.5.2, areas of Group H-1, H-2 and H-3 occupancies shall be located in a detached building or structure.
3. Uses within live/work units, complying with Section 419, are not considered separate occupancies.

**508.2 Accessory occupancies.** Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Accessory occupancies shall comply with the provisions of Sections 508.2.1 through 508.2.4.

**508.2.1 Area limitations.** Aggregate accessory occupancies shall not occupy more than 10 percent of the building area of the story in which they are located and shall not exceed the tabular values in Table 503, without building area increases in accordance with Section 506 for such accessory occupancies.

**508.2.2 Occupancy classification.** Accessory occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to

each portion of the building based on the occupancy classification of that space.

**508.2.3 Allowable building area and height.** The allowable building area and height of the building shall be based on the allowable building area and height for the main occupancy in accordance with Section 503.1. The height of each accessory occupancy shall not exceed the tabular values in Table 503, without increases in accordance with Section 504 for such accessory occupancies. The building area of the accessory occupancies shall be in accordance with Section 508.2.1.

**508.2.4 Separation of occupancies.** No separation is required between accessory occupancies and the main occupancy.

**Exceptions:**

1. Group H-2, H-3, H-4, H-5, *I-2, I-2.1, I-3 and L* occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group I-1, R-1, R-2, *R-2.1* and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from accessory occupancies contiguous to them in accordance with the requirements of Section 420.

**508.3 Nonseparated occupancies.** Buildings or portions of buildings that comply with the provisions of this section shall be considered as nonseparated occupancies.

**508.3.1 Occupancy Classification.** Nonseparated occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space. In addition, the most restrictive provisions of Chapter 9 which apply to the nonseparated occupancies shall apply to the total nonseparated occupancy area. Where nonseparated occupancies occur in a high-rise building, the most restrictive requirements of Section 403 which apply to the nonseparated occupancies shall apply throughout the high-rise building.

**508.3.2 Allowable building area and height.** The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1.

**508.3.3 Separation.** No separation is required between nonseparated occupancies.

**Exceptions:**

1. Group H-2, H-3, H-4, H-5, *I-2, I-2.1, I-3 and L* occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group R-1, R-2, *R-2.1* and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from other occu-

pancies contiguous to them in accordance with the requirements of Section 420.

**508.4 Separated occupancies.** Buildings or portions of buildings that comply with the provisions of this section shall be considered as separated occupancies.

**508.4.1 Occupancy classification.** Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with this code based on the occupancy classification of that portion of the building.

**508.4.2 Allowable building area.** In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1.

**508.4.3 Allowable height.** Each separated occupancy shall comply with the building height limitations based on the type of construction of the building in accordance with Section 503.1.

**Exception:** Special provisions permitted by Section 510 shall permit occupancies at building heights other than provided in Section 503.1.

**508.4.4 Separation.** Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

**508.4.4.1 Construction.** Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies.

## SECTION 509 INCIDENTAL USES

**509.1 General.** Incidental uses located within single occupancy or mixed occupancy buildings shall comply with the provisions of this section. Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses listed in Table 509.

**Exception:** Incidental uses within and serving a dwelling unit are not required to comply with this section.

**509.2 Occupancy classification.** Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located.

**509.3 Area limitations.** Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.

**509.4 Separation and protection.** The incidental uses listed in Table 509 shall be separated from the remainder of the building or equipped with an automatic sprinkler system, or both, in accordance with the provisions of that table.

**TABLE 508.4**  
**REQUIRED SEPARATION OF OCCUPANCIES (HOURS)**

OCCUPANCY	A, E		I-4, R-2.1		I-2, I-2.1		I-3		R-1, R-2, R-3, R-3.1, R-4		F-2, S-2 <sup>b</sup> , U		B, F-1, M <sup>e</sup> , S-1		L		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	2	2	2	NP	2	NP	1	2	N	1	1	2	2	NP	NP	NP	3	4	2	3 <sup>a</sup>	2	NP
I-4, R-2.1	—	—	I <sup>c</sup>	NP	2	NP	2	NP	1	NP	I	2	1	2	2	NP	NP	NP	4	NP	4	NP	4	NP
I-2, I-2.1	—	—	—	—	N	NP	2	NP	2	NP	2	NP	2	NP	2	NP	NP	NP	4	NP	4	NP	4	NP
I-3	—	—	—	—	—	—	N	NP	2	NP	2	2	2	2	2	NP	NP	NP	4	NP	4	NP	4	NP
R-1, R-2, R-3, R-3.1, R-4	—	—	—	—	—	—	—	—	N	N	I <sup>c</sup>	2 <sup>c</sup>	1	2	4	NP	NP	NP	3	NP	2	NP	2	NP
F-2, S-2 <sup>b</sup> , U	—	—	—	—	—	—	—	—	N	N	N	N	1	2	I	NP	NP	NP	3	4	2	3 <sup>a</sup>	2	NP
B, F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	—	—	N	N	I	NP	NP	NP	2	3	1	2 <sup>a</sup>	1	NP
L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	I	NP	NP	NP	2	NP	I	NP	I	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 <sup>d</sup>	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not permitted.

a. See Section 420.

b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but to not less than 1 hour.

c. See Section 406.3.4.

d. Separation is not required between occupancies of the same classification.

e. *[SFM] Group I and F1 occupancies and Group R-2.1 and F-1 occupancies shall have a 3 hour separation.*

**509.4.1 Separation.** Where Table 509 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both. Construction supporting 1-hour fire barriers or horizontal assemblies used for incidental use separations in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.

**509.4.2 Protection.** Where Table 509 permits an automatic sprinkler system without a fire barrier, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The walls shall extend from the top of the foundation or floor assembly below to the underside of the ceiling that is a component of a fire-resistance-rated floor assembly or roof assembly above or to the underside of the floor or roof sheathing, deck or slab above. Doors shall be self- or automatic-closing upon detection of smoke in accordance with Section 716.5.9.3. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80. Walls surrounding the incidental use shall not have air transfer

openings unless provided with smoke dampers in accordance with Section 710.7.

**509.4.2.1 Protection limitation.** Except as specified in Table 509 for certain incidental uses, where an automatic sprinkler system is provided in accordance with Table 509, only the space occupied by the incidental use need be equipped with such a system.

## SECTION 510 SPECIAL PROVISIONS

**510.1 General.** The provisions in Sections 510.2 through 510.9 shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable building heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code. The provisions of Sections 510.2 through 510.8 are to be considered independent and separate from each other.

**510.2 Horizontal building separation allowance.** A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire

**TABLE 509  
INCIDENTAL USES**

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system <sup>a</sup>
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system <sup>a</sup>
Refrigerant machinery room	1 hour or provide automatic sprinkler system <sup>a</sup>
Hydrogen cutoff rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
Laboratories and vocational shops, not classified as Group H, located in Group I-2 and I-2.1 occupancies	1 hour or provide automatic fire-extinguishing system <sup>a</sup>
<i>[SFM] Rooms or areas with special hazards such as laboratories, vocational shops and other such areas not classified as Group H, located in Group E occupancies where hazardous materials in quantities not exceeding the maximum allowable quantity are used or stored.</i>	1 hour
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system <sup>a</sup>
Storage rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system <sup>a</sup>
Waste and linen collection rooms located in either Group I-2 occupancies or ambulatory care facilities	1 hour
Waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system <sup>a</sup>
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterruptible power supplies	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies <sup>a</sup>

For SI: 1 square foot = 0.0929 m<sup>2</sup>, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L.

a. *[SFM] Fire barrier protection and automatic sprinkler protection required throughout the fire area in I-2 and I-2.1 occupancies as indicated.*

walls, limitation of number of stories and type of construction where all of the following conditions are met:

1. The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 3 hours.
2. The building below the horizontal assembly is not greater than one story above grade plane.
3. The building below the horizontal assembly is of Type IA construction.
4. Shaft, stairway, ramp and escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire-resistance rating with opening protectives in accordance with Section 716.5.

**Exception:** Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire-resistance rating with opening protectives in accordance with Section 716.5, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating, provided:

1. The building above the horizontal assembly is not required to be of Type I construction;
2. The enclosure connects fewer than four stories; and
3. The enclosure opening protectives above the horizontal assembly have a fire protection rating of not less than 1 hour.
5. The building or buildings above the horizontal assembly shall be permitted to have multiple Group A occupancy uses, each with an occupant load of less than 300, or Group B, M, R or S occupancies.
6. The building below the horizontal assembly shall be protected throughout by an approved automatic sprinkler system in accordance with Section 903.3.1.1, and shall be permitted to be any of the following occupancies:
  - 6.1. Group S-2 parking garage used for the parking and storage of private motor vehicles;
  - 6.2. Multiple Group A, each with an occupant load of less than 300;

- 6.3. Group B;
  - 6.4. Group M;
  - 6.5. Group R; and
  - 6.6. Uses incidental to the operation of the building (including entry lobbies, mechanical rooms, storage areas and similar uses).
7. The maximum building height in feet (mm) shall not exceed the limits set forth in Section 503 for the building having the smaller allowable height as measured from the grade plane.

**510.3 Group S-2 enclosed parking garage with Group S-2 open parking garage above.** A Group S-2 enclosed parking garage with not more than one story above grade plane and located below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction where all of the following conditions are met:

- 1. The allowable area of the building shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.
- 2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the fire-resistance requirements of the Group S-2 open parking garage.
- 3. The height and the number of tiers of the Group S-2 open parking garage shall be limited as specified in Table 406.5.4.
- 4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 open parking garage shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 open parking garage, except exit openings, shall not be required to be protected.
- 5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet (93 m<sup>2</sup>), and mechanical equipment rooms incidental to the operation of the building.

**510.4 Parking beneath Group R.** Where a maximum one story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in Section 508.4.

**510.5 Group R-1 and R-2 buildings of Type IIIA construction.** The height limitation for buildings of Type IIIA construction in Groups R-1 and R-2 shall be increased to six stories and 75 feet (22 860 mm) where the first floor assembly

above the basement has a fire-resistance rating of not less than 3 hours and the floor area is subdivided by 2-hour fire-resistance-rated fire walls into areas of not more than 3,000 square feet (279 m<sup>2</sup>).

**510.6 Group R-1 and R-2 buildings of Type IIA construction.** The height limitation for buildings of Type IIA construction in Groups R-1 and R-2 shall be increased to nine stories and 100 feet (30 480 mm) where the building is separated by not less than 50 feet (15 240 mm) from any other building on the lot and from lot lines, the exits are segregated in an area enclosed by a 2-hour fire-resistance-rated fire wall and the first floor assembly has a fire-resistance rating of not less than 1½ hours.

**510.7 Open parking garage beneath Groups A, I, B, M and R.** Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.5. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in Section 503 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.

**510.7.1 Fire separation.** Fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711 between the parking occupancy and the upper occupancy shall correspond to the required fire-resistance rating prescribed in Table 508.4 for the uses involved. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601. Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers having not less than a 2-hour fire-resistance rating as required by Section 706 with self-closing doors complying with Section 716 or horizontal assemblies having not less than a 2-hour fire-resistance rating as required by Section 711, with self-closing doors complying with Section 716. *Means of egress from the open parking garage shall comply with Section 406.5.*

**510.8 Group B or M with Group S-2 open parking garage.** Group B or M occupancies located not higher than the first story above grade plane shall be considered as a separate and distinct building for the purpose of determining the type of construction where all of the following conditions are met:

- 1. The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 2 hours.
- 2. The occupancies in the building below the horizontal assembly are limited to Groups B and M.
- 3. The occupancy above the horizontal assembly is limited to a Group S-2 open parking garage.



4. The building below the horizontal assembly is of Type I or II construction but not less than the type of construction required for the Group S-2 open parking garage above.
5. The height and area of the building below the horizontal assembly does not exceed the limits set forth in Section 503.
6. The height and area of the Group S-2 open parking garage does not exceed the limits set forth in Section 405.5. The height, in both feet and stories, of the Group S-2 open parking garage shall be measured from grade plane and shall include the building below the horizontal assembly.
7. Exits serving the Group S-2 open parking garage discharge directly to a street or public way and are separated from the building below the horizontal assembly by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

#### **510.9 Multiple buildings above a horizontal assembly.**

Where two or more buildings are provided above the horizontal assembly separating a Group S-2 parking garage or building below from the buildings above in accordance with the special provisions in Sections 510.2, 510.3 or 510.8, the buildings above the horizontal assembly shall be regarded as separate and distinct buildings from each other and shall comply with all other provisions of this code as applicable to each separate and distinct building.

**510.10 Group R. [SFM]** *Buildings housing protective social care homes or in occupancies housing inmates who are not restrained need not be of one-hour fire-resistive construction when not more than two stories in height. In no case shall individual floor areas exceed 3,000 square feet (279 m<sup>2</sup>). The fire-resistive protection of the exterior walls shall not be less than one hour where such walls are located within 5 feet (1524 mm) of the property line. Openings within such walls are not permitted. Openings in exterior nonrated walls need not be protected.*



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 6 – TYPES OF CONSTRUCTION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X		X	X			X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X																		
Adopt only those sections that are listed below																				
Chapter / Section																				
Table 601		X																		
602.1		X																		
Table 602		X																		
603.1		X																		
603.1.1		X																		
603.1.2		X																		
603.1.3		X																		



## CHAPTER 6

# TYPES OF CONSTRUCTION

### SECTION 601 GENERAL

**601.1 Scope.** The provisions of this chapter shall control the classification of buildings as to type of construction.

### SECTION 602 CONSTRUCTION CLASSIFICATION

**602.1 General.** Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602. Where required to have a fire-resistance rating by Table 601, building elements shall comply with the applicable provisions of Section 703.2. The pro-

tection of openings, ducts and air transfer openings in building elements shall not be required unless required by other provisions of this code.

**Exception:** Noncombustible structural members supporting solar photovoltaic panels are not required to meet the fire resistance rating for the following:

1. Photovoltaic panel supported by a structure and having no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
2. Solar photovoltaic (PV) panels supported by non-combustible framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

**TABLE 601  
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A <sup>d</sup>	B	A <sup>d</sup>	B	HT	A <sup>d</sup>	B
Primary structural frame <sup>g</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls									
Exterior <sup>f, g</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions									
Interior <sup>e</sup>	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1½ <sup>b</sup>	1 <sup>b, c</sup>	1 <sup>b, c</sup>	0 <sup>c</sup>	1 <sup>b, c</sup>	0	HT	1 <sup>b, c</sup>	0

For SI: 1 foot = 304.8 mm.

- a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- b.1. Except in Group A, E, F-1, H, I, L, M, R-1, R-2, R-2.1 and S-1 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- b.2. For Group A, E, I, L, R-1, R-2 and R-2.1 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, fire protection of members other than the structural frame shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- b.3. For one-story portions of Group A and E assembly occupancies the roof-framing system of Type II A or Type III A construction may be of unprotected construction when such roof-framing system is open to the assembly area and does not contain concealed spaces.
- c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
- d. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.
- e. Not less than the fire-resistance rating required by other sections of this code.
- f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
- g. Not less than the fire-resistance rating as referenced in Section 704.10

3. Solar photovoltaic panels supported by a structure over parking stalls where the panels constitute the roof and all the following conditions are met (see Figure 5-1):

- 3.1. The area within the perimeter of the solar photovoltaic array has maximum rectangular dimension of 40 feet by 150 feet.
- 3.2. The distance between solar photovoltaic array structures is a minimum of 10 feet clear.
- 3.3. The driveway aisle separating solar photovoltaic array structures has a minimum width of 25 feet clear.
- 3.4. Solar photovoltaic array structure is used only for parking purposes with no storage.
- 3.5. Completely open on all sides (other than necessary structural supports) with no interior partitions.

**602.1.1 Minimum requirements.** A building or portion thereof shall not be required to conform to the details of a type of construction higher than that type which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction.

**602.2 Types I and II.** Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in this code.

**602.3 Type III.** Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.

**602.4 Type IV.** Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of this section. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies with a 2-hour rating or less. Minimum solid sawn nominal dimensions are required for structures built using Type IV construction (HT). For glued-laminated members the equivalent net finished width and depths corresponding to the minimum nominal width and depths of solid sawn lumber are required as specified in Table 602.4.

**TABLE 602.4  
WOOD MEMBER SIZE EQUIVALENCIES**

MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE	
Width, inch	Depth, inch	Width, inch	Depth, inch
8	8	6 <sup>3</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>4</sub>
6	10	5	10 <sup>1</sup> / <sub>2</sub>
6	8	5	8 <sup>1</sup> / <sub>4</sub>
6	6	5	6
4	6	3	6 <sup>7</sup> / <sub>8</sub>

For SI: 1 inch = 25.4 mm.

**602.4.1 Columns.** Wood columns shall be sawn or glued laminated and shall be not less than 8 inches (203 mm), nominal, in any dimension where supporting floor loads and not less than 6 inches (152 mm) nominal in width and not less than 8 inches (203 mm) nominal in depth where supporting roof and ceiling loads only. Columns shall be continuous or superimposed and connected in an approved manner.

**TABLE 602  
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE<sup>a, e</sup>**

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H <sup>f</sup> , L	OCCUPANCY GROUP F-1, M, S-1 <sup>g</sup>	OCCUPANCY GROUP A, B, E, F-2, I, R <sup>h, i</sup> , S-2 <sup>g</sup> , U <sup>b, h, i</sup>
x < 5 <sup>c</sup>	All	3	2	1
5 ≤ x < 10	IA	3	2	1
	Others	2	1	1
10 ≤ x < 30	IA, IB	2	1	1 <sup>d</sup>
	IIB, VB	1	0	0
	Others	1	1	1 <sup>d</sup>
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.

b. For special requirements for Group U occupancies, see Section 406.3.

c. See Section 706.1.1 for party walls.

d. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.

e. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.

f. For special requirements for Group H occupancies, see Section 415.5.

g. For special requirements for Group S aircraft hangars, see Section 412.4.1.

h. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.

i. Group R-3 and Group U occupancies when used as accessory to Group R-3 occupancies, shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet or more; or when equipped throughout with an automatic residential fire sprinkler system installed in accordance with Section 903.3 the fire-resistance rating shall not be required where the fire separation distance is 3 feet or more.

**602.4.2 Floor framing.** Wood beams and girders shall be of sawn or glued-laminated timber and shall be not less than 6 inches (152 mm) nominal in width and not less than 10 inches (254 mm) nominal in depth. Framed sawn or glued-laminated timber arches, which spring from the floor line and support floor loads, shall be not less than 8 inches (203 mm) nominal in any dimension. Framed timber trusses supporting floor loads shall have members of not less than 8 inches (203 mm) nominal in any dimension.

**602.4.3 Roof framing.** Wood-frame or glued-laminated arches for roof construction, which spring from the floor line or from grade and do not support floor loads, shall have members not less than 6 inches (152 mm) nominal in width and have not less than 8 inches (203 mm) nominal in depth for the lower half of the height and not less than 6 inches (152 mm) nominal in depth for the upper half. Framed or glued-laminated arches for roof construction—that spring from the top of walls or wall abutments, framed timber trusses and other roof framing, which do not support floor loads, shall have members not less than 4 inches (102 mm) nominal in width and not less than 6 inches (152 mm) nominal in depth. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches (76 mm) nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches (51 mm) nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches (76 mm) nominal in thickness. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches (76 mm) nominal in width.

**602.4.4 Floors.** Floors shall be without concealed spaces. Wood floors shall be of sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, or 0.5-inch (12.7 mm) particleboard or planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or  $1\frac{5}{32}$ -inch (12 mm) wood structural panel or 0.5-inch (12.7 mm) particleboard. The lumber shall be laid so that no continuous line of joints will occur except at points of support. Floors shall not extend closer than 0.5 inch (12.7 mm) to walls. Such 0.5-inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbeling of masonry walls under the floor shall be permitted to be used in place of molding.

**602.4.5 Roofs.** Roofs shall be without concealed spaces and wood roof decks shall be sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness,  $1\frac{1}{8}$ -inch-thick (32 mm) wood structural panel (exterior glue), or of planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors. Other types of

decking shall be permitted to be used if providing equivalent fire resistance and structural properties.

**602.4.6 Partitions.** Partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

**602.4.7 Exterior structural members.** Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes shall be permitted to be used externally.

**602.5 Type V.** Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by this code.

## SECTION 603 COMBUSTIBLE MATERIAL IN TYPE I AND II CONSTRUCTION

**603.1 Allowable materials.** Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. Fire-retardant-treated wood shall be permitted in:
  - 1.1. Nonbearing partitions where the required fire-resistance rating is 2 hours or less.
  - 1.2. Nonbearing exterior walls where fire-resistance rated construction is not required.
  - 1.3. Roof construction, including girders, trusses, framing and decking.

**Exception:** In buildings of Type IA construction exceeding two stories above grade plane, fire-retardant-treated wood is not permitted in roof construction where the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).

2. Thermal and acoustical insulation, other than foam plastics, having a flame spread index of not more than 25.

### Exceptions:

1. Insulation placed between two layers of non-combustible materials without an intervening airspace shall be allowed to have a flame spread index of not more than 100.
2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a flame spread index of not more than 200.
3. Foam plastics in accordance with Chapter 26.
4. Roof coverings that have an A, B or C classification.
5. Interior floor finish and floor covering materials installed in accordance with Section 804.
6. Millwork such as doors, door frames, window sashes and frames.

## TYPES OF CONSTRUCTION

7. Interior wall and ceiling finishes installed in accordance with Sections 801 and 803.
8. Trim installed in accordance with Section 806.
9. Where not installed greater than 15 feet (4572 mm) above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.
10. Finish flooring installed in accordance with Section 805.
11. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a corridor serving an occupant load of 30 or more shall be permitted to be constructed of fire-retardant-treated wood, 1-hour fire-resistance-rated construction or of wood panels or similar light construction up to 6 feet (1829 mm) in height.
12. Stages and platforms constructed in accordance with Sections 410.3 and 410.4, respectively.
13. Combustible exterior wall coverings, balconies and similar projections and bay or oriel windows in accordance with Chapter 14.
14. Blocking such as for handrails, millwork, cabinets and window and door frames.
15. Light-transmitting plastics as permitted by Chapter 26.
16. Mastics and caulking materials applied to provide flexible seals between components of exterior wall construction.
17. Exterior plastic veneer installed in accordance with Section 2605.2.
18. Nailing or furring strips as permitted by Section 803.4.
19. Heavy timber as permitted by Note c to Table 601 and Sections 602.4.7 and 1406.3.
20. Aggregates, component materials and admixtures as permitted by Section 703.2.2.
21. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of fire-resistance tests in accordance with Section 703.2 and installed in accordance with Sections 1705.13 and 1705.14, respectively.
22. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 714.
23. Materials used to protect joints in fire-resistance-rated assemblies in accordance with Section 715.
24. Materials allowed in the concealed spaces of buildings of Types I and II construction in accordance with Section 718.5.
25. Materials exposed within plenums complying with Section 602 of the *California Mechanical Code*.

**603.1.1 Ducts.** The use of nonmetallic ducts shall be permitted where installed in accordance with the limitations of the *California Mechanical Code*.

**603.1.2 Piping.** The use of combustible piping materials shall be permitted where installed in accordance with the limitations of the *California Mechanical Code* and the *California Plumbing Code*.

**603.1.3 Electrical.** The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted where installed in accordance with the limitations of the *California Electrical Code*.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 7 – FIRE AND SMOKE PROTECTION FEATURES

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X									X			X		
Chapter / Section																				
> 702.1		X																		
703.4																				
703.5																				
> 705.5		X																		
705.8.1		X																		
705.8.5		X																		
705.12		X																		
Table 706.4		X																		
707.1		X																		
Table 707.3.10		X																		
708.1		X																		
708.3		X																		
708.4		X																		
710.2		X																		
710.8		X																		
712.1.3		X																		
712.1.5		X																		
712.1.8		X																		
713.14.1		X																		
716.5.3		X																		
716.5.5		X																		
716.5.5.1		X																		
716.5.7.1		X																		
> 716.5.9.3		X																		
717.2.2		X																		
717.5.2		X																		
717.5.3		X																		
717.5.4		X																		
717.5.4.1		X																		
717.6.1		X																		
717.6.2		X																		
717.6.3		X																		
718.3.3		X																		
718.4.3		X																		
718.5		X																		
720.1		X																		
720.7		X																		
721.2			X	X																
821.2.1			X	X																



## CHAPTER 7

# FIRE AND SMOKE PROTECTION FEATURES

### SECTION 701 GENERAL

**701.1 Scope.** The provisions of this chapter shall govern the materials, systems and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

**701.2 Multiple use fire assemblies.** Fire assemblies that serve multiple purposes in a building shall comply with all of the requirements that are applicable for each of the individual fire assemblies.

### SECTION 702 DEFINITIONS

**702.1 Definitions.** The following terms are defined in Chapter 2:

**ANNULAR SPACE.**

**BUILDING ELEMENT.**

**CEILING RADIATION DAMPER.**

**COMBINATION FIRE/SMOKE DAMPER.**

**DAMPER.**

**DRAFTSTOP**

**F RATING.**

**FIRE BARRIER.**

**FIRE DAMPER.**

**FIRE DOOR.**

**FIRE DOOR ASSEMBLY.**

**FIRE PARTITION.**

**FIRE PROTECTION RATING.**

**FIRE-RATED GLAZING.**

**FIRE RESISTANCE.**

**FIRE-RESISTANCE RATING.**

**FIRE-RESISTANT JOINT SYSTEM.**

**FIRE SEPARATION DISTANCE.**

***FIRE-SMOKE BARRIER.***

**FIRE WALL.**

**FIRE WINDOW ASSEMBLY.**

**FIREBLOCKING.**

**FLOOR FIRE DOOR ASSEMBLY.**

**HORIZONTAL ASSEMBLY.**

**JOINT.**

**L RATING.**

**MEMBRANE PENETRATION.**

**MEMBRANE-PENETRATION FIRESTOP.**

**MEMBRANE-PENETRATION FIRESTOP SYSTEM.**

**MINERAL FIBER.**

**MINERAL WOOL.**

**PENETRATION FIRESTOP.**

**SELF-CLOSING.**

**SHAFT.**

**SHAFT ENCLOSURE.**

**SMOKE BARRIER.**

**SMOKE COMPARTMENT.**

**SMOKE DAMPER.**

**SPLICE.**

**T RATING.**

**THROUGH PENETRATION.**

**THROUGH-PENETRATION FIRESTOP SYSTEM.**

### SECTION 703 FIRE-RESISTANCE RATINGS AND FIRE TESTS

**703.1 Scope.** Materials prescribed herein for fire resistance shall conform to the requirements of this chapter.

**703.2 Fire-resistance ratings.** The fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTM E 119 or UL 263 or in accordance with Section 703.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements, components or assemblies shall not reduce the required fire-resistance rating.

**Exception:** In determining the fire-resistance rating of exterior bearing walls, compliance with the ASTM E 119 or UL 263 criteria for unexposed surface temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required fire-resistance rating of an exterior non-bearing wall with the same fire separation distance, and in a building of the same group. When the fire-resistance rating determined in accordance with this exception exceeds the fire-resistance rating determined in accordance with

ASTM E 119 or UL 263, the fire exposure time period, water pressure and application duration criteria for the hose stream test of ASTM E 119 or UL 263 shall be based upon the fire-resistance rating determined in accordance with this exception.

**703.2.1 Nonsymmetrical wall construction.** Interior walls and partitions of nonsymmetrical construction shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests conducted in compliance with ASTM E 119 or UL 263. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side (see Section 705.5 for exterior walls).

**703.2.2 Combustible components.** Combustible aggregates are permitted in gypsum and Portland cement concrete mixtures for fire-resistance-rated construction. Any component material or admixture is permitted in assemblies if the resulting tested assembly meets the fire-resistance test requirements of this code.

**703.2.3 Restrained classification.** Fire-resistance-rated assemblies tested under ASTM E 119 or UL 263 shall not be considered to be restrained unless evidence satisfactory to the building official is furnished by the registered design professional showing that the construction qualifies for a restrained classification in accordance with ASTM E 119 or UL 263. Restrained construction shall be identified on the plans.

**703.3 Alternative methods for determining fire resistance.** The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E 119 or UL 263. The required fire resistance of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures:

1. Fire-resistance designs documented in sources.
2. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in Section 721.
3. Calculations in accordance with Section 722.
4. Engineering analysis based on a comparison of building element, component or assemblies designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E 119 or UL 263.
5. Alternative protection methods as allowed by Section 104.11.

**703.4 Automatic sprinklers.** Under the prescriptive fire-resistance requirements of the *California Building Code*, the fire-resistance rating of a building element, component or assembly shall be established without the use of automatic sprinklers or any other fire suppression system being incorporated as part of the assembly tested in accordance with the fire exposure, procedures, and acceptance criteria specified in ASTM E 119 or UL 263. However, this section shall not pro-

hibit or limit the duties and powers of the building official allowed by Sections 104.10 and 104.11.

**703.5 Noncombustibility tests.** The tests indicated in Sections 703.5.1 and 703.5.2 shall serve as criteria for acceptance of building materials as set forth in Sections 602.2, 602.3 and 602.4 in Type I, II, III and IV construction. The term “noncombustible” does not apply to the flame spread characteristics of interior finish or trim materials. A material shall not be classified as a noncombustible building construction material if it is subject to an increase in combustibility or flame spread beyond the limitations herein established through the effects of age, moisture or other atmospheric conditions.

**703.5.1 Elementary materials.** Materials required to be noncombustible shall be tested in accordance with ASTM E 136.

**703.5.2 Composite materials.** Materials having a structural base of noncombustible material as determined in accordance with Section 703.5.1 with a surfacing not more than 0.125 inch (3.18 mm) thick that has a flame spread index not greater than 50 when tested in accordance with ASTM E 84 or UL 723 shall be acceptable as noncombustible materials.

**703.6 Fire-resistance-rated glazing.** Fire-resistance-rated glazing, when tested in accordance with ASTM E 119 or UL 263 and complying with the requirements of Section 707, shall be permitted. Fire-resistance-rated glazing shall bear a label marked in accordance with Table 716.3 issued by an agency and shall be permanently identified on the glazing.

**703.7 Marking and identification.** Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
2. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches (76 mm) in height with a minimum  $\frac{3}{8}$  inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording. “FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS” or other wording.

**Exception:** Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

## SECTION 704 FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS

**704.1 Requirements.** The fire-resistance ratings of structural members and assemblies shall comply with this section and the requirements for the type of construction as specified in Table 601. The fire-resistance ratings shall not be less than

the ratings required for the fire-resistance-rated assemblies supported by the structural members.

**Exception:** Fire barriers, fire partitions, smoke barriers and horizontal assemblies as provided in Sections 707.5, 708.4, 709.4 and 711.4, respectively.

**704.2 Column protection.** Where columns are required to have protection to be fire-resistance rated, the entire column shall be provided individual encasement protection by protecting it on all sides for the full column length, including connections to other structural members, with materials having the required fire-resistance rating. Where the column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

**704.3 Protection of the primary structural frame other than columns.** Members of the primary structural frame other than columns that are required to have protection to achieve a fire-resistance rating and support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be provided individual encasement protection by protecting them on all sides for the full length, including connections to other structural members, with materials having the required fire-resistance rating.

**Exception:** Individual encasement protection on all sides shall be permitted on all exposed sides provided the extent of protection is in accordance with the required fire-resistance rating, as determined in Section 703.

**704.4 Protection of secondary members.** Secondary members that are required to have a fire-resistance rating shall be protected by individual encasement protection, by the membrane or ceiling of a horizontal assembly in accordance with Section 711, or by a combination of both.

**704.4.1 Light-frame construction.** King studs and boundary elements that are integral elements in load-bearing walls of light-frame construction shall be permitted to have required fire-resistance ratings provided by the membrane protection provided for the load-bearing wall.

**704.5 Truss protection.** The required thickness and construction of fire-resistance-rated assemblies enclosing trusses shall be based on the results of full-scale tests or combinations of tests on truss components or on approved calculations based on such tests that satisfactorily demonstrate that the assembly has the required fire resistance.

**704.6 Attachments to structural members.** The edges of lugs, brackets, rivets and bolt heads attached to structural members shall be permitted to extend to within 1 inch (25 mm) of the surface of the fire protection.

**704.7 Reinforcing.** Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties are permitted to project not more than 0.5-inch (12.7 mm) into the protection.

**704.8 Embedments and enclosures.** Pipes, wires, conduits, ducts or other service facilities shall not be embedded in the required fire protective covering of a structural member that is required to be individually encased.

**704.9 Impact protection.** Where the fire protective covering of a structural member is subject to impact damage from moving vehicles, the handling of merchandise or other activity, the fire protective covering shall be protected by corner guards or by a substantial jacket of metal or other noncombustible material to a height adequate to provide full protection, but not less than 5 feet (1524 mm) from the finished floor.

**Exception:** Corner protection is not required on concrete columns in open or enclosed parking garages.

**704.10 Exterior structural members.** Load-bearing structural members located within the exterior walls or on the outside of a building or structure shall be provided with the highest fire-resistance rating as determined in accordance with the following:

1. As required by Table 601 for the type of building element based on the type of construction of the building;
2. As required by Table 601 for exterior bearing walls based on the type of construction; and
3. As required by Table 602 for exterior walls based on the fire separation distance.

**704.11 Bottom flange protection.** Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than 6 feet 4 inches (1931 mm) whether part of the primary structural frame or not, and from the bottom flange of lintels, shelf angles and plates not part of the structural frame, regardless of span.

**704.12 Seismic isolation systems.** Fire-resistance ratings for the isolation system shall meet the fire-resistance rating required for the columns, walls or other structural elements in which the isolation system is installed in accordance with Table 601. Isolation systems required to have a fire-resistance rating shall be protected with approved materials or construction assemblies designed to provide the same degree of fire resistance as the structural element in which it is installed when tested in accordance with ASTM E 119 or UL 263 (see Section 703.2).

Such isolation system protection applied to isolator units shall be capable of retarding the transfer of heat to the isolator unit in such a manner that the required gravity load-carrying capacity of the isolator unit will not be impaired after exposure to the standard time-temperature curve fire test prescribed in ASTM E 119 or UL 263 for a duration not less than that required for the fire-resistance rating of the structure element in which it is installed.

Such isolation system protection applied to isolator units shall be suitably designed and securely installed so as not to dislodge, loosen, sustain damage or otherwise impair its ability to accommodate the seismic movements for which the isolator unit is designed and to maintain its integrity for the purpose of providing the required fire-resistance protection.

**704.13 Sprayed fire-resistant materials (SFRM).** Sprayed fire-resistant materials (SFRM) shall comply with Sections 704.13.1 through 704.13.5.

**704.13.1 Fire-resistance rating.** The application of SFRM shall be consistent with the fire-resistance rating

and the listing, including, but not limited to, minimum thickness and dry density of the applied SFRM, method of application, substrate surface conditions and the use of bonding adhesives, sealants, reinforcing or other materials.

**704.13.2 Manufacturer's installation instructions.** The application of SFRM shall be in accordance with the manufacturer's installation instructions. The instructions shall include, but are not limited to, substrate temperatures and surface conditions and SFRM handling, storage, mixing, conveyance, method of application, curing and ventilation.

**704.13.3 Substrate condition.** The SFRM shall be applied to a substrate in compliance with Sections 704.13.3.1 through 704.13.3.2.

**704.13.3.1 Surface conditions.** Substrates to receive SFRM shall be free of dirt, oil, grease, release agents, loose scale and any other condition that prevents adhesion. The substrates shall also be free of primers, paints and encapsulants other than those fire tested and listed by a nationally recognized testing agency. Primed, painted or encapsulated steel shall be allowed, provided that testing has demonstrated that required adhesion is maintained.

**704.13.3.2 Primers, paints and encapsulants.** Where the SFRM is to be applied over primers, paints or encapsulants other than those specified in the listing, the material shall be field tested in accordance with ASTM E 736. Where testing of the SFRM with primers, paints or encapsulants demonstrates that required adhesion is maintained, SFRM shall be permitted to be applied to primed, painted or encapsulated wide flange steel shapes in accordance with the following conditions:

1. The beam flange width does not exceed 12 inches (305 mm); or
2. The column flange width does not exceed 16 inches (400 mm); or
3. The beam or column web depth does not exceed 16 inches (400 mm).
4. The average and minimum bond strength values shall be determined based on a minimum of five bond tests conducted in accordance with ASTM E 736. Bond tests conducted in accordance with ASTM E 736 shall indicate a minimum average bond strength of 80 percent and a minimum individual bond strength of 50 percent, when compared to the bond strength of the SFRM as applied to clean uncoated  $\frac{1}{8}$ -inch thick (3 mm) steel plate.

**704.13.4 Temperature.** A minimum ambient and substrate temperature of 40°F (4.44°C) shall be maintained during and for a minimum of 24 hours after the application of the SFRM, unless the manufacturer's installation instructions allow otherwise.

**704.13.5 Finished condition.** The finished condition of SFRM applied to structural members or assemblies shall not, upon complete drying or curing, exhibit cracks, voids,

spalls, delamination or any exposure of the substrate. Surface irregularities of SFRM shall be deemed acceptable.

## SECTION 705 EXTERIOR WALLS

**705.1 General.** Exterior walls shall comply with this section.

**705.2 Projections.** Cornices, eave overhangs, exterior balconies and similar projections extending beyond the exterior wall shall conform to the requirements of this section and Section 1406. Exterior egress balconies and exterior exit stairways and ramps shall also comply with Sections 1019 and 1026, respectively. Projections shall not extend any closer to the line used to determine the fire separation distance than shown in Table 705.2.

**TABLE 705.2  
MINIMUM DISTANCE OF PROJECTION**

FIRE SEPARATION DISTANCE (FSD)	MINIMUM DISTANCE FROM LINE USED TO DETERMINE FSD
0 feet to less than 2 feet	Projections not permitted
2 feet to less than 5 feet	24 inches
5 feet or greater	40 inches

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm.

**Exception:** Buildings on the same lot and considered as portions of one building in accordance with Section 705.3 are not required to comply with this section.

**705.2.1 Type I and II construction.** Projections from walls of Type I or II construction shall be of noncombustible materials or combustible materials as allowed by Sections 1406.3 and 1406.4.

**705.2.2 Type III, IV or V construction.** Projections from walls of Type III, IV or V construction shall be of any approved material.

**705.2.3 Combustible projections.** Combustible projections extending to within 5 feet (1524 mm) of the line used to determine the fire separation distance, or located where openings are not permitted, or where protection of some openings is required shall be of at least 1-hour fire-resistance-rated construction, Type IV construction, fire-retardant-treated wood or as required by Section 1406.3.

**Exception:** Type VB construction shall be allowed for combustible projections in Group R-3 and U occupancies with a fire separation distance greater than or equal to 5 feet (1524 mm).

**705.3 Buildings on the same lot.** For the purposes of determining the required wall and opening protection, projections and roof-covering requirements, buildings on the same lot shall be assumed to have an imaginary line between them.

Where a new building is to be erected on the same lot as an existing building, the location of the assumed imaginary line with relation to the existing building shall be such that the exterior wall and opening protection of the existing building meet the criteria as set forth in Sections 705.5 and 705.8.

**Exception:** Two or more buildings on the same lot shall either be regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in Chapter 5

for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.

**705.4 Materials.** Exterior walls shall be of materials permitted by the building type of construction.

**705.5 Fire-resistance ratings.** *For other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602 and this section. The required fire-resistance rating of exterior walls with a fire separation distance of greater than 10 feet (3048 mm) shall be rated for exposure to fire from the inside. The required fire-resistance rating of exterior walls with a fire separation distance of less than or equal to 10 feet (3048 mm) shall be rated for exposure to fire from both sides.*

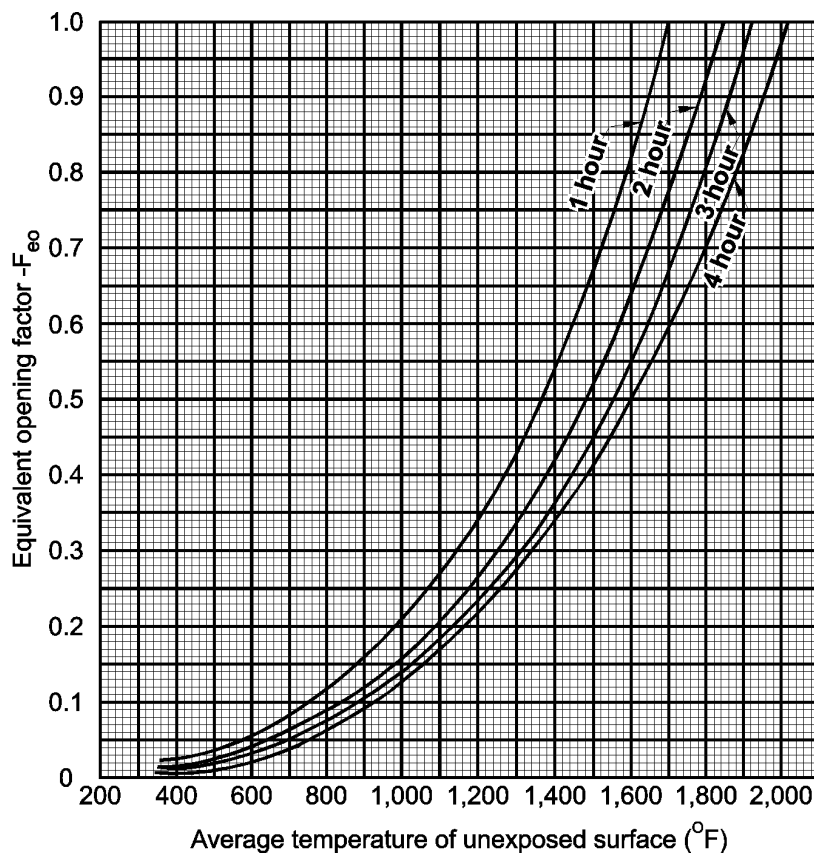
*For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602 and this section. The required fire-resistance rating of exterior walls shall be rated for exposure to fire from both sides.*

**705.6 Structural stability.** The wall shall extend to the height required by Section 705.11 and shall have sufficient structural stability such that it will remain in place for the duration of time indicated by the required fire-resistance rating. Where exterior walls have a minimum fire separation distance of not less than 30 feet (9144 mm), interior structural elements which brace the exterior wall but which are not located within the plane of the exterior wall shall have the minimum fire-resistance rating required in Table 601 for that structural element. Structural elements which brace the exterior wall but are located outside of the exterior wall or within the plane of the exterior wall shall have the minimum fire-resistance rating required in Tables 601 and 602 for the exterior wall.

**705.7 Unexposed surface temperature.** Where protected openings are not limited by Section 705.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 or UL 263 shall not apply. Where protected openings are limited by Section 705.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 or UL 263 shall not apply provided that a correction is made for radiation from the unexposed exterior wall surface in accordance with the following formula:

$$A_c = A + (A_t \times F_{eo})$$

(Equation 7-1)



For SI:  $^{\circ}\text{C} = [(^{\circ}\text{F}) - 32] / 1.8$ .

FIGURE 705.7  
EQUIVALENT OPENING FACTOR

## FIRE AND SMOKE PROTECTION FEATURES

where:

$A_e$  = Equivalent area of protected openings.

$A$  = Actual area of protected openings.

$A_f$  = Area of exterior wall surface in the story under consideration exclusive of openings, on which the temperature limitations of ASTM E 119 or UL 263 for walls are exceeded.

$F_{eo}$  = An "equivalent opening factor" derived from Figure 705.7 based on the average temperature of the unexposed wall surface and the fire-resistance rating of the wall.

**705.8 Openings.** Openings in exterior walls shall comply with Sections 705.8.1 through 705.8.6.

**705.8.1 Allowable area of openings.** The maximum area of unprotected and protected openings permitted in an exterior wall in any story of a building shall not exceed the percentages specified in Table 705.8.

### Exceptions:

1. In other than Group H occupancies, unlimited unprotected openings are permitted in the first story above grade plane either:

1.1. Where the wall faces a street and has a fire separation distance of more than 15 feet (4572 mm); or

1.2. Where the wall faces an unoccupied space. The unoccupied space shall be on

**TABLE 705.8  
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON  
FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION**

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA <sup>a</sup>
0 to less than 3 <sup>b, c</sup>	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	Not Permitted
	Protected (P)	Not Permitted
3 to less than 5 <sup>d, e</sup>	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	15%
	Protected (P)	15%
5 to less than 10 <sup>e, f, j</sup>	Unprotected, Nonsprinklered (UP, NS)	10% <sup>h</sup>
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	25%
	Protected (P)	25%
10 to less than 15 <sup>e, f, g</sup>	Unprotected, Nonsprinklered (UP, NS)	15% <sup>h</sup>
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	45%
	Protected (P)	45%
15 to less than 20 <sup>f, g</sup>	Unprotected, Nonsprinklered (UP, NS)	25%
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	75%
	Protected (P)	75%
20 to less than 25 <sup>f, g</sup>	Unprotected, Nonsprinklered (UP, NS)	45%
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	No Limit
	Protected (P)	No Limit
25 to less than 30 <sup>f, g</sup>	Unprotected, Nonsprinklered (UP, NS)	70%
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	No Limit
	Protected (P)	No Limit
30 or greater	Unprotected, Nonsprinklered (UP, NS)	No Limit
	Unprotected, Sprinklered (UP, S) <sup>i</sup>	Not Required
	Protected (P)	Not Required

For SI: 1 foot = 304.8 mm.

UP, NS = Unprotected openings in buildings not equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

UP, S = Unprotected openings in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

P = Openings protected with an opening protective assembly in accordance with Section 705.8.2.

a. Values indicated are the percentage of the area of the exterior wall, per story.

b. For the requirements for fire walls of buildings with differing heights, see Section 706.6.1.

c. For openings in a fire wall for buildings on the same lot, see Section 706.8.

d. The maximum percentage of unprotected and protected openings shall be 25 percent for Group R-3 occupancies.

e. Unprotected openings shall not be permitted for openings with a fire separation distance of less than 15 feet for Group H-2 and H-3 occupancies.

f. The area of unprotected and protected openings shall not be limited for Group R-3 occupancies, with a fire separation distance of 5 feet or greater.

g. The area of openings in an open parking structure with a fire separation distance of 10 feet or greater shall not be limited.

h. Includes buildings accessory to Group R-3.

i. Not applicable to Group H-1, H-2 and H-3 occupancies.

j. For special requirements for Group U occupancies, see Section 406.3.2.



the same lot or dedicated for public use, shall not be less than 30 feet (9144 mm) in width and shall have access from a street by a posted fire lane in accordance with the *California Fire Code*.

2. Buildings whose exterior bearing walls, exterior nonbearing walls and exterior primary structural frame are not required to be fire-resistance rated shall be permitted to have unlimited unprotected openings.

**705.8.2 Protected openings.** Where openings are required to be protected, fire doors and fire shutters shall comply with Section 716.5 and fire window assemblies shall comply with Section 716.6.

**Exception:** Opening protectives are not required where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and the exterior openings are protected by a water curtain using automatic sprinklers approved for that use.

**705.8.3 Unprotected openings.** Where unprotected openings are permitted, windows and doors shall be constructed of any approved materials. Glazing shall conform to the requirements of Chapters 24 and 26.

**705.8.4 Mixed openings.** Where both unprotected and protected openings are located in the exterior wall in any story of a building, the total area of openings shall be determined in accordance with the following:

$$(A_p/a_p) + (A_u/a_u) \leq 1 \quad \text{(Equation 7-2)}$$

where:

$A_p$  = Actual area of protected openings, or the equivalent area of protected openings,  $A_e$  (see Section 705.7).

$a_p$  = Allowable area of protected openings.

$A_u$  = Actual area of unprotected openings.

$a_u$  = Allowable area of unprotected openings.

**705.8.5 Vertical separation of openings.** Openings in exterior walls in adjacent stories shall be separated vertically to protect against fire spread on the exterior of the buildings where the openings are within 5 feet (1524 mm) of each other horizontally and the opening in the lower story is not a protected opening with a fire protection rating of not less than  $3/4$  hour. Such openings shall be separated vertically at least 3 feet (914 mm) by spandrel girders, exterior walls or other similar assemblies that have a fire-resistance rating of at least 1 hour or by flame barriers that extend horizontally at least 30 inches (762 mm) beyond the exterior wall. Flame barriers shall also have a fire-resistance rating of at least 1 hour. The unexposed surface temperature limitations specified in ASTM E 119 or UL 263 shall not apply to the flame barriers or vertical separation unless otherwise required by the provisions of this code.

**Exceptions:**

1. This section shall not apply to buildings that are three stories or less above grade plane.

2. This section shall not apply to buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

3. Open parking garages.

**705.8.6 Vertical exposure.** For buildings on the same lot, opening protectives having a fire protection rating of not less than  $3/4$  hour shall be provided in every opening that is less than 15 feet (4572 mm) vertically above the roof of an adjacent building or structure based on assuming an imaginary line between them. The opening protectives are required where the fire separation distance between the imaginary line and the adjacent building or structure is less than 15 feet (4572 mm).

**Exceptions:**

1. Opening protectives are not required where the roof assembly of the adjacent building or structure has a fire-resistance rating of not less than 1 hour for a minimum distance of 10 feet (3048 mm) from the exterior wall facing the imaginary line and the entire length and span of the supporting elements for the fire-resistance-rated roof assembly has a fire-resistance rating of not less than 1 hour.
2. Buildings on the same lot and considered as portions of one building in accordance with Section 705.3 are not required to comply with Section 705.8.6.

**705.9 Joints.** Joints made in or between exterior walls required by this section to have a fire-resistance rating shall comply with Section 715.

**Exception:** Joints in exterior walls that are permitted to have unprotected openings.

**705.9.1 Voids.** The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 715.4.

**705.10 Ducts and air transfer openings.** Penetrations by air ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings shall comply with Section 717.

**Exception:** Foundation vents installed in accordance with this code are permitted.

**705.11 Parapets.** Parapets shall be provided on exterior walls of buildings.

**Exceptions:** A parapet need not be provided on an exterior wall where any of the following conditions exist:

1. The wall is not required to be fire-resistance rated in accordance with Table 602 because of fire separation distance.
2. The building has an area of not more than 1,000 square feet (93 m<sup>2</sup>) on any floor.
3. Walls that terminate at roofs of not less than 2-hour fire-resistance-rated construction or where the roof, including the deck or slab and supporting construction, is constructed entirely of noncombustible materials.

4. One-hour fire-resistance-rated exterior walls that terminate at the underside of the roof sheathing, deck or slab, provided:

- 4.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction for a width of 4 feet (1220 mm) for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.

- 4.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction.

- 4.3. Openings in the roof shall not be located within 5 feet (1524 mm) of the 1-hour fire-resistance-rated exterior wall for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.

- 4.4. The entire building shall be provided with not less than a Class B roof covering.

5. In Groups R-2 and R-3 where the entire building is provided with a Class C roof covering, the exterior wall shall be permitted to terminate at the underside of the roof sheathing or deck in Type III, IV and V construction, provided:

- 5.1. The roof sheathing or deck is constructed of approved noncombustible materials or of fire-retardant-treated wood for a distance of 4 feet (1220 mm); or

- 5.2. The roof is protected with 0.625-inch (16 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm).

6. Where the wall is permitted to have at least 25 percent of the exterior wall areas containing unprotected openings based on fire separation distance as determined in accordance with Section 705.8.

**705.11.1 Parapet construction.** Parapets shall have the same fire-resistance rating as that required for the supporting wall, and on any side adjacent to a roof surface, shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials. The height of the parapet shall not be less than 30 inches (762 mm) above the point where the roof surface and the wall intersect. Where the roof slopes toward a parapet at a slope greater than two units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a fire separation distance where protection of wall openings is required, but

in no case shall the height be less than 30 inches (762 mm).

**705.12 Exterior graphics on exterior walls of high-rise buildings.** Where installed on the exterior walls of high-rise buildings, exterior graphics, both permanent and temporary, greater than 100 square feet in area or greater than 10 feet in either dimension shall comply with the following conditions subject to the review and approval of the fire code official and building official:

1. The materials used for graphics installed at a height greater than 40 feet above the grade plane shall be noncombustible materials or shall have a flame spread index not greater than 25 when tested in accordance with ASTM E 84 or UL 723.
2. The method of attachment and mounting of the graphics to the exterior wall shall be such that the graphics are securely attached.
3. The graphics shall not interfere with the active or passive ventilation required for the building and the required smoke control systems in the building.
4. The graphics shall not impair the functions of any fire or life safety systems in the building.

## SECTION 706 FIRE WALLS

**706.1 General.** Each portion of a building separated by one or more fire walls that comply with the provisions of this section shall be considered a separate building. The extent and location of such fire walls shall provide a complete separation. Where a fire wall also separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply.

**706.1.1 Party walls.** Any wall located on a lot line between adjacent buildings, which is used or adapted for joint service between the two buildings, shall be constructed as a fire wall in accordance with Section 706. Party walls shall be constructed without openings and shall create separate buildings.

**Exception:** Openings in a party wall separating an anchor building and a mall shall be in accordance with Section 402.7.3.1.

**706.2 Structural stability.** Fire walls shall have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall for the duration of time indicated by the required fire-resistance rating or shall be constructed as double fire walls in accordance with NFPA 221.

**706.3 Materials.** Fire walls shall be of any approved noncombustible materials.

**Exception:** Buildings of Type V construction.

**706.4 Fire-resistance rating.** Fire walls shall have a fire-resistance rating of not less than that required by Table 706.4.

**TABLE 706.4**  
**FIRE WALL FIRE-RESISTANCE RATINGS**

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, R-2.1, U, L	3 <sup>a</sup>
F-1, H-3 <sup>b</sup> , H-5, M, S-1	3
H-1, H-2	4 <sup>b</sup>
F-2, S-2, R-3, R-4	2

a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.

b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.6 and 415.7.

**706.5 Horizontal continuity.** Fire walls shall be continuous from exterior wall to exterior wall and shall extend at least 18 inches (457 mm) beyond the exterior surface of exterior walls.

**Exceptions:**

1. Fire walls shall be permitted to terminate at the interior surface of combustible exterior sheathing or siding provided the exterior wall has a fire-resistance rating of at least 1 hour for a horizontal distance of at least 4 feet (1220 mm) on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than  $\frac{3}{4}$  hour.
2. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing, exterior siding or other noncombustible exterior finishes provided the sheathing, siding, or other exterior noncombustible finish extends a horizontal distance of at least 4 feet (1220 mm) on both sides of the fire wall.
3. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing where the building on each side of the fire wall is protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

**706.5.1 Exterior walls.** Where the fire wall intersects exterior walls, the fire-resistance rating and opening protection of the exterior walls shall comply with one of the following:

1. The exterior walls on both sides of the fire wall shall have a 1-hour fire-resistance rating with  $\frac{3}{4}$ -hour protection where opening protection is required by Section 705.8. The fire-resistance rating of the exterior wall shall extend a minimum of 4 feet (1220 mm) on each side of the intersection of the fire wall to exterior wall. Exterior wall intersections at fire walls that form an angle equal to or greater than 180 degrees (3.14 rad) do not need exterior wall protection.
2. Buildings or spaces on both sides of the intersecting fire wall shall assume to have an imaginary lot line at the fire wall and extending beyond the exterior of the fire wall. The location of the assumed line in relation to the exterior walls and the fire wall shall be such that the exterior wall and opening protection

meet the requirements set forth in Sections 705.5 and 705.8. Such protection is not required for exterior walls terminating at fire walls that form an angle equal to or greater than 180 degrees (3.14 rad).

**706.5.2 Horizontal projecting elements.** Fire walls shall extend to the outer edge of horizontal projecting elements such as balconies, roof overhangs, canopies, marquees and similar projections that are within 4 feet (1220 mm) of the fire wall.

**Exceptions:**

1. Horizontal projecting elements without concealed spaces, provided the exterior wall behind and below the projecting element has not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting element on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than  $\frac{3}{4}$  hour.
2. Noncombustible horizontal projecting elements with concealed spaces, provided a minimum 1-hour fire-resistance-rated wall extends through the concealed space. The projecting element shall be separated from the building by a minimum of 1-hour fire-resistance-rated construction for a distance on each side of the fire wall equal to the depth of the projecting element. The wall is not required to extend under the projecting element where the building exterior wall is not less than 1-hour fire-resistance rated for a distance on each side of the fire wall equal to the depth of the projecting element. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than  $\frac{3}{4}$  hour.
3. For combustible horizontal projecting elements with concealed spaces, the fire wall need only extend through the concealed space to the outer edges of the projecting elements. The exterior wall behind and below the projecting element shall be of not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting elements on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire-protection rating of not less than  $\frac{3}{4}$  hour.

**706.6 Vertical continuity.** Fire walls shall extend from the foundation to a termination point at least 30 inches (762 mm) above both adjacent roofs.

**Exceptions:**

1. Stepped buildings in accordance with Section 706.6.1.
2. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab, provided:
  - 2.1. The lower roof assembly within 4 feet (1220 mm) of the wall has not less than a 1-hour

fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than 1 hour.

- 2.2. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.
- 2.3. Each building shall be provided with not less than a Class B roof covering.
3. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck or slabs where both buildings are provided with not less than a Class B roof covering. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.
4. In buildings of Type III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks, provided:
  - 4.1. There are no openings in the roof within 4 feet (1220 mm) of the fire wall,
  - 4.2. The roof is covered with a minimum Class B roof covering, and
  - 4.3. The roof sheathing or deck is constructed of fire-retardant-treated wood for a distance of 4 feet (1220 mm) on both sides of the wall or the roof is protected with  $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of 2-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm) on both sides of the fire wall.
5. In buildings designed in accordance with Section 510.2, fire walls located above the 3-hour horizontal assembly required by Section 510.2, Item 1 shall be permitted to extend from the top of this horizontal assembly.
6. Buildings with sloped roofs in accordance with Section 706.6.2.

**706.6.1 Stepped buildings.** Where a fire wall serves as an exterior wall for a building and separates buildings having different roof levels, such wall shall terminate at a point not less than 30 inches (762 mm) above the lower roof level, provided the exterior wall for a height of 15 feet (4572 mm) above the lower roof is not less than 1-hour fire-resistance-rated construction from both sides with openings protected by fire assemblies having a fire protection rating of not less than  $\frac{3}{4}$  hour.

**Exception:** Where the fire wall terminates at the underside of the roof sheathing, deck or slab of the lower roof, provided:

1. The lower roof assembly within 10 feet (3048 mm) of the wall has not less than a 1-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than 1 hour.

2. Openings in the lower roof shall not be located within 10 feet (3048 mm) of the fire wall.

**706.6.2 Buildings with sloped roofs.** Where a fire wall serves as an interior wall for a building, and the roof on one side or both sides of the fire wall slopes toward the fire wall at a slope greater than two units vertical in 12 units horizontal (2:12), the fire wall shall extend to a height equal to the height of the roof located 4 feet (1219 mm) from the fire wall plus 30 inches (762 mm). In no case shall the extension of the fire wall be less than 30 inches (762 mm).

**706.7 Combustible framing in fire walls.** Adjacent combustible members entering into a concrete or masonry fire wall from opposite sides shall not have less than a 4-inch (102 mm) distance between embedded ends. Where combustible members frame into hollow walls or walls of hollow units, hollow spaces shall be solidly filled for the full thickness of the wall and for a distance not less than 4 inches (102 mm) above, below and between the structural members, with non-combustible materials approved for fireblocking.

**706.8 Openings.** Each opening through a fire wall shall be protected in accordance with Section 716.5 and shall not exceed 156 square feet (15 m<sup>2</sup>). The aggregate width of openings at any floor level shall not exceed 25 percent of the length of the wall.

**Exceptions:**

1. Openings are not permitted in party walls constructed in accordance with Section 706.1.1.
2. Openings shall not be limited to 156 square feet (15 m<sup>2</sup>) where both buildings are equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

**706.9 Penetrations.** Penetrations of fire walls shall comply with Section 714.

**706.10 Joints.** Joints made in or between fire walls shall comply with Section 715.

**706.11 Ducts and air transfer openings.** Ducts and air transfer openings shall not penetrate fire walls.

**Exception:** Penetrations by ducts and air transfer openings of fire walls that are not on a lot line shall be allowed provided the penetrations comply with Section 717. The size and aggregate width of all openings shall not exceed the limitations of Section 706.8.

## SECTION 707 FIRE BARRIERS

**707.1 General.** Fire barriers installed as required elsewhere in this code or the *California Fire Code* shall comply with this section.

**707.2 Materials.** Fire barriers shall be of materials permitted by the building type of construction.

**707.3 Fire-resistance rating.** The fire-resistance rating of fire barriers shall comply with this section.

**707.3.1 Shaft enclosures.** The fire-resistance rating of the fire barrier separating building areas from a shaft shall comply with Section 713.4.

**707.3.2 Interior exit stairway and ramp construction.** The fire-resistance rating of the fire barrier separating building areas from an interior exit stairway or ramp shall comply with Section 1022.1.

**707.3.3 Enclosures for exit access stairways.** The fire-resistance rating of the fire barrier separating building areas from an exit access stairway or ramp shall comply with Section 1009.3.1.2.

**707.3.4 Exit passageway.** The fire-resistance rating of the fire barrier separating building areas from an exit passageway shall comply with Section 1023.3.

**707.3.5 Horizontal exit.** The fire-resistance rating of the separation between building areas connected by a horizontal exit shall comply with Section 1025.1.

**707.3.6 Atriums.** The fire-resistance rating of the fire barrier separating atriums shall comply with Section 404.6.

**707.3.7 Incidental uses.** The fire barrier separating incidental uses from other spaces in the building shall have a fire-resistance rating of not less than that indicated in Table 509.

**707.3.8 Control areas.** Fire barriers separating control areas shall have a fire-resistance rating of not less than that required in Section 414.2.4.

**707.3.9 Separated occupancies.** Where the provisions of Section 508.4 are applicable, the fire barrier separating mixed occupancies shall have a fire-resistance rating of not less than that indicated in Table 508.4 based on the occupancies being separated.

**707.3.10 Fire areas.** The fire barriers or horizontal assemblies, or both, separating a single occupancy into different fire areas shall have a fire-resistance rating of not less than that indicated in Table 707.3.10. The fire barriers or horizontal assemblies, or both, separating fire areas of mixed occupancies shall have a fire-resistance rating of not less than the highest value indicated in Table 707.3.10 for the occupancies under consideration.

**TABLE 707.3.10  
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE  
BARRIER ASSEMBLIES OR HORIZONTAL ASSEMBLIES  
BETWEEN FIRE AREAS**

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, L, M, R, S-2	2
U	1

**707.4 Exterior walls.** Where exterior walls serve as a part of a required fire-resistance-rated shaft or stairway or ramp enclosure, or separation, such walls shall comply with the requirements of Section 705 for exterior walls and the fire-resistance-rated enclosure or separation requirements shall not apply.

**Exception:** Exterior walls required to be fire-resistance rated in accordance with Section 1019 for exterior egress balconies, Section 1022.7 for interior exit stairways and ramps and Section 1026.6 for exterior exit stairways and ramp.

**707.5 Continuity.** Fire barriers shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above and shall be securely attached thereto. Such fire barriers shall be continuous through concealed space, such as the space above a suspended ceiling. Joints and voids at intersections shall comply with Sections 707.8 and 707.9

**707.5.1 Supporting construction.** The supporting construction for a fire barrier shall be protected to afford the required fire-resistance rating of the fire barrier supported. Hollow vertical spaces within a fire barrier shall be fire-blocked in accordance with Section 718.2 at every floor level.

**Exceptions:**

1. The maximum required fire-resistance rating for assemblies supporting fire barriers separating tank storage as provided for in Section 415.8.2.1 shall be 2 hours, but not less than required by Table 601 for the building construction type.
2. Shaft enclosures shall be permitted to terminate at a top enclosure complying with Section 713.12.
3. Supporting construction for 1-hour fire barriers required by Table 509 in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.
4. Interior exit stairway and ramp enclosures required by Section 1022.2 and exit access stairway and ramp enclosures required by Section 1009.3 shall be permitted to terminate at a top enclosure complying with Section 713.12.

**707.6 Openings.** Openings in a fire barrier shall be protected in accordance with Section 716. Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 156 square feet (15 m<sup>2</sup>). Openings in enclosures for exit access stairways and ramps, interior exit stairways and ramps and exit passageways shall also comply with Sections 1022.3 and 1023.5, respectively.

**Exceptions:**

1. Openings shall not be limited to 156 square feet (15 m<sup>2</sup>) where adjoining floor areas are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Openings shall not be limited to 156 square feet (15 m<sup>2</sup>) or an aggregate width of 25 percent of the length of the wall where the opening protective is a fire door serving enclosures for exit access stairways, exit access ramps, interior exit stairways and interior exit ramps.

3. Openings shall not be limited to 156 square feet (15 m<sup>2</sup>) or an aggregate width of 25 percent of the length of the wall where the opening protective has been tested in accordance with ASTM E 119 or UL 263 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall.
4. Fire window assemblies permitted in atrium separation walls shall not be limited to a maximum aggregate width of 25 percent of the length of the wall.
5. Openings shall not be limited to 156 square feet (15 m<sup>2</sup>) or an aggregate width of 25 percent of the length of the wall where the opening protective is a fire door assembly in a fire barrier separating an enclosure for exit access stairways, exit access ramps, interior exit stairways and interior exit ramps from an exit passageway in accordance with Section 1022.2.1.

**707.7 Penetrations.** Penetrations of fire barriers shall comply with Section 714.

**707.7.1 Prohibited penetrations.** Penetrations into enclosures for exit access stairways, exit access ramps, interior exit stairways, interior exit ramps or an exit passageway shall be allowed only when permitted by Section 1009.3.1.5, 1022.5 or 1023.6, respectively.

**707.8 Joints.** Joints made in or between fire barriers, and joints made at the intersection of fire barriers with underside of a fire-resistance rated floor or roof sheathing, slab, or deck above, and the exterior vertical wall intersection shall comply with Section 715.

**707.9 Voids at intersections.** The voids created at the intersection of a fire barrier and a non-fire-resistance-rated roof assembly shall be filled. An approved material or system shall be used to fill the void, shall be securely installed in or on the intersection for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to retard the passage of fire and hot gases.

**707.10 Ducts and air transfer openings.** Penetrations in a fire barrier by ducts and air transfer openings shall comply with Section 717.

## SECTION 708 FIRE PARTITIONS

**708.1 General.** The following wall assemblies shall comply with this section.

1. Walls separating dwelling units in the same building as required by Section 420.2.
2. Walls separating sleeping units in the same building as required by Section 420.2.
3. Walls separating tenant spaces in covered and open mall buildings as required by Section 402.4.2.1.
4. Corridor walls as required by Section 1018.1.
5. Elevator lobby separation as required by Section 713.14.1.

6. Walls separating enclosed tenant spaces in high-rise buildings and in buildings of Types I, IIA, IIIA, IV or VA construction of Group A, E, H, I, L and R-2.1 occupancies and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal.

**708.2 Materials.** The walls shall be of materials permitted by the building type of construction.

**708.3 Fire-resistance rating.** Fire partitions shall have a fire-resistance rating of not less than 1 hour.

### Exceptions:

1. Corridor walls permitted to have a 1/2 hour fire-resistance rating by Table 1018.1.
2. Dwelling unit and sleeping unit separations in buildings of Type IIB, IIIB and VB construction shall have fire-resistance ratings of not less than 1/2 hour in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Walls separating enclosed tenant spaces in Group B high-rise buildings of Type I and II construction equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**708.4 Continuity.** Fire partitions shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above or to the fire-resistance-rated floor/ceiling or roof/ceiling assembly above, and shall be securely attached thereto. In combustible construction where the fire partitions are not required to be continuous to the sheathing, deck or slab, the space between the ceiling and the sheathing, deck or slab above shall be fire-blocked or draftstopped in accordance with Sections 718.2 and 718.3 at the partition line. The supporting construction shall be protected to afford the required fire-resistance rating of the wall supported, except for walls separating tenant spaces in covered and open mall buildings, walls separating dwelling units, walls separating sleeping units and corridor walls, in buildings of Type IIB, IIIB and VB construction.

### Exceptions:

1. The wall need not be extended into the crawl space below where the floor above the crawl space has a minimum 1-hour fire-resistance rating.
2. Where the room-side fire-resistance-rated membrane of the corridor is carried through to the underside of the floor or roof sheathing, deck or slab of a fire-resistance-rated floor or roof above, the ceiling of the corridor shall be permitted to be protected by the use of ceiling materials as required for a 1-hour fire-resistance-rated floor or roof system.
3. Where the corridor ceiling is constructed as required for the corridor walls, the walls shall be permitted to terminate at the upper membrane of such ceiling assembly.
4. The fire partitions separating tenant spaces in a covered or open mall building, complying with Section 402.7.2, are not required to extend beyond the underside of a ceiling that is not part of a fire-resis-

tance-rated assembly. A wall is not required in attic or ceiling spaces above tenant separation walls.

5. Attic fireblocking or draftstopping is not required at the partition line in Group R-2 buildings that do not exceed four stories above grade plane, provided the attic space is subdivided by draftstopping into areas not exceeding 3,000 square feet (279 m<sup>2</sup>) or above every two dwelling units, whichever is smaller.
6. Fireblocking or draftstopping is not required at the partition line in buildings equipped with an automatic sprinkler system installed throughout in accordance with Section 903.3.1.1 or 903.3.1.2, provided that automatic sprinklers are installed in *all* combustible floor/ceiling and roof/ceiling spaces.

**708.5 Exterior walls.** Where exterior walls serve as a part of a required fire-resistance-rated separation, such walls shall comply with the requirements of Section 705 for exterior walls, and the fire-resistance-rated separation requirements shall not apply.

**Exception:** Exterior walls required to be fire-resistance rated in accordance with Section 1019.2 for exterior egress balconies, Section 1022.7 for interior exit stairways and ramps and Section 102.6.6 for exterior exit stairways and ramps.

**708.6 Openings.** Openings in a fire partition shall be protected in accordance with Section 716.

**708.7 Penetrations.** Penetrations of fire partitions shall comply with Section 714.

**708.8 Joints.** Joints made in or between fire partitions shall comply with Section 715.

**708.9 Ducts and air transfer openings.** Penetrations in a fire partition by ducts and air transfer openings shall comply with Section 717.

## SECTION 709 SMOKE BARRIERS

**709.1 General.** Smoke barriers shall comply with this section.

**709.2 Materials.** Smoke barriers shall be of materials permitted by the building type of construction.

**709.3 Fire-resistance rating.** A 1-hour fire-resistance rating is required for smoke barriers.

**Exception:** Smoke barriers constructed of minimum 0.10-inch-thick (2.5 mm) steel in Group I-3 buildings.

**709.4 Continuity.** Smoke barriers shall form an effective membrane continuous from outside wall to outside wall and from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required fire-resistance rating of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction.

### Exceptions:

1. Smoke-barrier walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings that provide resistance to the passage of fire and smoke equivalent to that provided by the smoke-barrier walls.
2. Smoke barriers used for elevator lobbies in accordance with Section 405.4.3, 3007.4.2 or 3008.11.2 are not required to extend from outside wall to outside wall.
3. Smoke barriers used for areas of refuge in accordance with Section 1007.6.2 are not required to extend from outside wall to outside wall.

**709.5 Openings.** Openings in a smoke barrier shall be protected in accordance with Section 716.

### Exceptions:

1. In Group I-2 and ambulatory care facilities, where doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with fire-protection-rated glazing materials in fire-protection-rated frames, the area of which shall not exceed that tested. The doors shall be close fitting within operational tolerances, and shall not have undercuts in excess of <sup>3</sup>/<sub>4</sub>-inch, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges and shall be automatic-closing by smoke detection in accordance with Section 716.5.9.3. Where permitted by the door manufacturer's listing, positive-latching devices are not required.
2. In Group I-2 and ambulatory care facilities, horizontal sliding doors installed in accordance with Section 1008.1.4.3 and protected in accordance with Section 716.

**709.6 Penetrations.** Penetrations of smoke barriers shall comply with Section 714.

**709.7 Joints.** Joints made in or between smoke barriers shall comply with Section 715.

**709.8 Ducts and air transfer openings.** Penetrations in a smoke barrier by ducts and air transfer openings shall comply with Section 717.

## SECTION 710 SMOKE PARTITIONS

**710.1 General.** Smoke partitions installed as required elsewhere in the code shall comply with this section.

**710.2 Materials.** The walls shall be of materials permitted by the building type of construction. *In Group I-2 and I-2.1, smoke partitions shall have framing covered with noncombustible materials having an approved thermal barrier with an index of not less than 15 in accordance with FM 4880, UL 1040, NFPA 286 or UL 1715.*

**710.3 Fire-resistance rating.** Unless required elsewhere in the code, smoke partitions are not required to have a fire-resistance rating.

**710.4 Continuity.** Smoke partitions shall extend from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

**710.5 Openings.** Openings in smoke partitions shall comply with Sections 710.5.1 and 710.5.2.

**710.5.1 Windows.** Windows in smoke partitions shall be sealed to resist the free passage of smoke or be automatic-closing upon detection of smoke.

**710.5.2 Doors.** Doors in smoke partitions shall comply with Sections 710.5.2.1 through 710.5.2.3.

**710.5.2.1 Louvers.** Doors in smoke partitions shall not include louvers.

**710.5.2.2 Smoke and draft control doors.** Where required elsewhere in the code, doors in smoke partitions shall meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot ( $0.015424 \text{ m}^3/(\text{s} \cdot \text{m}^2)$ ) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature test and the elevated temperature exposure test. Installation of smoke doors shall be in accordance with NFPA 105.

**710.5.2.3 Self- or automatic-closing doors.** Where required elsewhere in the code, doors in smoke partitions shall be self- or automatic-closing by smoke detection in accordance with Section 716.5.9.3.

**710.6 Penetrations.** The space around penetrating items shall be filled with an approved material to limit the free passage of smoke.

**710.7 Joints.** Joints shall be filled with an approved material to limit the free passage of smoke.

**710.8 Ducts and air transfer openings.** The space around a duct penetrating a smoke partition shall be filled with an approved material to limit the free passage of smoke. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with Section 717.3.2.2. *For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, duct openings in smoke partitions shall also be provided with a smoke damper complying with Section 717.3.2.2.*

**Exception:**

1. Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.
2. [SFM] Smoke dampers are not required in corridor penetrations where the duct is constructed of steel

*not less than 0.019-inch (0.40 mm) in thickness and there are no openings serving the corridor.*

## SECTION 711 HORIZONTAL ASSEMBLIES

**711.1 General.** Floor and roof assemblies required to have a fire-resistance rating shall comply with this section. Nonfire-resistance-rated floor and roof assemblies shall comply with Section 714.4.2.

**711.2 Materials.** The floor and roof assemblies shall be of materials permitted by the building type of construction.

**711.3 Fire-resistance rating.** The fire-resistance rating of floor and roof assemblies shall not be less than that required by the building type of construction. Where the floor assembly separates mixed occupancies, the assembly shall have a fire-resistance rating of not less than that required by Section 508.4 based on the occupancies being separated. Where the floor assembly separates a single occupancy into different fire areas, the assembly shall have a fire-resistance rating of not less than that required by Section 707.3.10. Horizontal assemblies separating dwelling units in the same building and horizontal assemblies separating sleeping units in the same building shall be a minimum of 1-hour fire-resistance-rated construction.

**Exception:** Dwelling unit and sleeping unit separations in buildings of Type IIB, IIIB and VB construction shall have fire-resistance ratings of not less than  $\frac{1}{2}$  hour in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**711.3.1 Ceiling panels.** Where the weight of lay-in ceiling panels, used as part of fire-resistance-rated floor/ceiling or roof/ceiling assemblies, is not adequate to resist an upward force of 1 pound per square foot (48 Pa), wire or other approved devices shall be installed above the panels to prevent vertical displacement under such upward force.

**711.3.2 Access doors.** Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies provided such doors are tested in accordance with ASTM E 119 or UL 263 as horizontal assemblies and labeled by an approved agency for such purpose.

**711.3.3 Unusable space.** In 1-hour fire-resistance-rated floor assemblies, the ceiling membrane is not required to be installed over unusable crawl spaces. In 1-hour fire-resistance-rated roof assemblies, the floor membrane is not required to be installed where unusable attic space occurs above.

**711.4 Continuity.** Assemblies shall be continuous without openings, penetrations or joints except as permitted by this section and Sections 712.1, 714.4, 715, 1009.3 and 1022.1. Skylights and other penetrations through a fire-resistance-rated roof deck or slab are permitted to be unprotected, provided that the structural integrity of the fire-resistance-rated roof assembly is maintained. Unprotected skylights shall not be permitted in roof assemblies required to be fire-resistance



rated in accordance with Section 705.8.6. The supporting construction shall be protected to afford the required fire-resistance rating of the horizontal assembly supported.

**Exception:** In buildings of Type IIB, IIIB or VB construction, the construction supporting the horizontal assembly is not required to be fire-resistance-rated at the following:

1. Horizontal assemblies at the separations of incidental uses as specified by Table 509, provided the required fire-resistance rating does not exceed 1 hour.
2. Horizontal assemblies at the separations of dwelling units and sleeping units as required by Section 420.3.
3. Horizontal assemblies at smoke barriers constructed in accordance with Section 709.

**711.4.1 Nonfire-resistance-rated assemblies.** Joints in or between floor assemblies without a required fire-resistance rating shall comply with one of the following:

1. The joint shall be concealed within the cavity of a wall.
2. The joint shall be located above a ceiling.
3. The joint shall be sealed, treated or covered with an approved material or system to resist the free passage of flame and the products of combustion.

**Exception:** Joints meeting one of the joint exceptions listed in Section 715.1.

**711.5 Penetrations.** Penetrations of horizontal assemblies, whether concealed or unconcealed, shall comply with Section 714.

**711.6 Joints.** Joints made in or between horizontal assemblies shall comply with Section 715. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 715.4.

**711.7 Ducts and air transfer openings.** Penetrations in horizontal assemblies by ducts and air transfer openings shall comply with Section 717.

**711.8 Floor fire door assemblies.** Floor fire door assemblies used to protect openings in fire-resistance-rated floors shall be tested in accordance with NFPA 288, and shall achieve a fire-resistance rating not less than the assembly being penetrated. Floor fire door assemblies shall be labeled by an approved agency. The label shall be permanently affixed and shall specify the manufacturer, the test standard and the fire-resistance rating.

**711.9 Smoke barrier.** Where horizontal assemblies are required to resist the movement of smoke by other sections of this code in accordance with the definition of smoke barrier, penetrations and joints in such horizontal assemblies shall be protected as required for smoke barriers in accordance with Sections 714.5 and 715.6. Regardless of the number of stories connected by elevator shaft enclosures, doors located in elevator shaft enclosures that penetrate the horizontal assembly shall be protected by enclosed elevator lobbies complying with Section 713.14.1. Openings through horizontal assem-

blies shall be protected by shaft enclosures complying with Section 713. Horizontal assemblies shall not be allowed to have unprotected vertical openings.

## SECTION 712 VERTICAL OPENINGS

\*\*

**712.1 General.** The provisions of this section shall apply to the vertical opening applications listed in Sections 712.1.1 through 712.1.18.

**712.1.1 Shaft enclosures.** Vertical openings contained entirely within a shaft enclosure complying with Section 713 shall be permitted.

**712.1.2 Individual dwelling unit.** Unconcealed vertical openings totally within an individual residential dwelling unit and connecting four stories or less shall be permitted.

**712.1.3 Escalator openings.** *In other than Groups I-2, I-2.1 and I-3*, where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, an escalator opening shall be protected according to Section 712.1.3.1 or 712.1.3.2.

**712.1.3.1 Opening size.** Protection by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 shall be permitted where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the escalator. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.

**712.1.3.2 Automatic shutters.** Protection of the opening by approved shutters at every penetrated floor shall be permitted in accordance with this section. The shutters shall be of noncombustible construction and have a fire-resistance rating of not less than 1.5 hours. The shutter shall be so constructed as to close immediately upon the actuation of a smoke detector installed in accordance with Section 907.3.1 and shall completely shut off the well opening. Escalators shall cease operation when the shutter begins to close. The shutter shall operate at a speed of not more than 30 feet per minute (152.4 mm/s) and shall be equipped with a sensitive leading edge to arrest its progress where in contact with any obstacle, and to continue its progress on release there from.

**712.1.4 Penetrations.** Penetrations shall be protected in accordance with Section 714.

**712.1.5 Ducts.** Penetrations by ducts shall be protected in accordance with Section 717.6. Grease ducts shall be protected in accordance with the *California Mechanical Code*.

**712.1.6 Atriums.** In other than Group H occupancies, atriums complying with Section 404 shall be permitted.

**712.1.7 Masonry chimney.** Approved masonry chimneys shall be permitted where the annular space is fireblocked at each floor level in accordance with Section 718.2.5.

**712.1.8 Two-story openings.** In other than Groups I-2, I-2.1 and I-3, a floor opening that is not used as one of the

applications listed in this section shall be permitted if it complies with all of the items below.

1. Does not connect more than two stories.
2. Does not contain a stairway or ramp required by Chapter 10.
3. Does not penetrate a horizontal assembly that separates fire areas or smoke barriers that separate smoke compartments.
4. Is not concealed within the construction of a wall or a floor/ceiling assembly.
5. Is not open to a corridor in Group I and R occupancies.
6. Is not open to a corridor on nonsprinklered floors.
7. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required shaft enclosures.

**712.1.9 Parking garages.** Automobile ramps in open and enclosed parking garages shall be permitted where constructed in accordance with Sections 406.5 and 406.6, respectively.

**712.1.10 Mezzanine.** Vertical openings between a mezzanine complying with Section 505 and the floor below shall be permitted.

**712.1.11 Joints.** Joints shall be permitted where complying with Section 715.

**712.1.12 Unenclosed stairs and ramps.** Vertical floor openings created by unenclosed stairs or ramps in accordance with Sections 1009.2 and 1009.3 shall be permitted.

**712.1.13 Floor fire doors.** Vertical openings shall be permitted where protected by floor fire doors in accordance with Section 711.8.

**712.1.14. Group I-3.** In Group I-3 occupancies, vertical openings shall be permitted in accordance with Section 408.5.

**712.1.15 Elevators in parking garages.** Vertical openings for elevator hoistways in open or enclosed parking garages that serve only the parking garage, and complying with Sections 406.5 and 406.6 respectively, shall be permitted.

**712.1.16 Duct systems in parking garages.** Vertical openings for mechanical exhaust or supply duct systems in open or enclosed parking garages complying with Sections 406.5 and 406.6 respectively, shall be permitted to be unenclosed where such duct system is contained within and serves only the parking garage.

**712.1.17 Nonfire-resistance-rated joints.** Joints in or between floors without a required fire-resistance rating shall be permitted in accordance with Section 711.4.1.

**712.1.18 Openings otherwise permitted.** Vertical openings shall be permitted where allowed by other sections of this code.

## SECTION 713 SHAFT ENCLOSURES

\*\*

**713.1 General.** The provisions of this section shall apply to shafts required to protect openings and penetrations through floor/ceiling and roof/ceiling assemblies. Exit access stairways and exit access ramps shall be protected in accordance with the applicable provisions of Section 1009. Interior exit stairways and interior exit ramps shall be protected in accordance with the requirements of Section 1022.

**713.2 Construction.** Shaft enclosures shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies in accordance with Section 711, or both.

**713.3 Materials.** The shaft enclosure shall be of materials permitted by the building type of construction.

**713.4 Fire-resistance rating.** Shaft enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours. Shaft enclosures shall meet the requirements of Section 703.2.1.

**713.5 Continuity.** Shaft enclosures shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, and shall have continuity in accordance with Section 707.5 for fire barriers or Section 711.4 for horizontal assemblies as applicable.

**713.6 Exterior walls.** Where exterior walls serve as a part of a required shaft enclosure, such walls shall comply with the requirements of Section 705 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

**Exception:** Exterior walls required to be fire-resistance rated in accordance with Section 1019.2 for exterior egress balconies, Section 1022.7 for interior exit stairways and ramps and Section 1026.6 for exterior exit stairways and ramps.

**713.7 Openings.** Openings in a shaft enclosure shall be protected in accordance with Section 716 as required for fire barriers. Doors shall be self- or automatic-closing by smoke detection in accordance with Section 716.5.9.3.

**713.7.1 Prohibited openings.** Openings other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

**713.8 Penetrations.** Penetrations in a shaft enclosure shall be protected in accordance with Section 714 as required for fire barriers. Structural elements, such as beams or joists, where protected in accordance with Section 714 shall be permitted to penetrate a shaft enclosure.

**713.8.1 Prohibited penetrations.** Penetrations other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

**713.9 Joints.** Joints in a shaft enclosure shall comply with Section 715.

**713.10 Duct and air transfer openings.** Penetrations of a shaft enclosure by ducts and air transfer openings shall comply with Section 717.

**713.11 Enclosure at the bottom.** Shafts that do not extend to the bottom of the building or structure shall comply with one of the following:

1. They shall be enclosed at the lowest level with construction of the same fire-resistance rating as the lowest floor through which the shaft passes, but not less than the rating required for the shaft enclosure.
2. They shall terminate in a room having a use related to the purpose of the shaft. The room shall be separated from the remainder of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating and opening protectives shall be at least equal to the protection required for the shaft enclosure.
3. They shall be protected by approved fire dampers installed in accordance with their listing at the lowest floor level within the shaft enclosure.

**Exceptions:**

1. The fire-resistance-rated room separation is not required, provided there are no openings in or penetrations of the shaft enclosure to the interior of the building except at the bottom. The bottom of the shaft shall be closed off around the penetrating items with materials permitted by Section 718.3.1 for draftstopping, or the room shall be provided with an approved automatic sprinkler system.
2. A shaft enclosure containing a refuse chute or laundry chute shall not be used for any other purpose and shall terminate in a room protected in accordance with Section 713.13.4.
3. The fire-resistance-rated room separation and the protection at the bottom of the shaft are not required provided there are no combustibles in the shaft and there are no openings or other penetrations through the shaft enclosure to the interior of the building.

**713.12 Enclosure at top.** A shaft enclosure that does not extend to the underside of the roof sheathing, deck or slab of the building shall be enclosed at the top with construction of the same fire-resistance rating as the topmost floor penetrated by the shaft, but not less than the fire-resistance rating required for the shaft enclosure.

**713.13 Refuse and laundry chutes.** In other than Group I-2, refuse and laundry chutes, access and termination rooms and incinerator rooms shall meet the requirements of Sections 713.13.1 through 713.13.6.

**Exceptions:**

1. Chutes serving and contained within a single dwelling unit.
2. Refuse and laundry chutes in Group I-2 shall comply with the provisions of NFPA 82, Chapter 5.

**713.13.1 Refuse, recycling and laundry chute enclosures.** A shaft enclosure containing a refuse, recycling, or laundry chute shall not be used for any other purpose and shall be enclosed in accordance with Section 713.4. Openings into the shaft, including those from access rooms and termination rooms, shall be protected in accordance with this section and Section 716. Openings into chutes shall not be located in corridors. Doors shall be self- or automatic-closing upon the actuation of a smoke detector in accordance with Section 716.5.9.3, except that heat-activated closing devices shall be permitted between the shaft and the termination room.

**713.13.2 Materials.** A shaft enclosure containing a refuse, recycling, or laundry chute shall be constructed of materials as permitted by the building type of construction.

**713.13.3 Refuse, recycling and laundry chute access rooms.** Access openings for refuse, recycling and laundry chutes shall be located in rooms or compartments enclosed by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings into the access rooms shall be protected by opening protectives having a fire protection rating of not less than  $\frac{3}{4}$  hour. Doors shall be self- or automatic-closing upon the detection of smoke in accordance with Section 716.5.9.3.

**713.13.4 Termination room.** Refuse, recycling, and laundry chutes shall discharge into an enclosed room separated from the remainder of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings into the termination room shall be protected by opening protectives having a fire protection rating equal to the protection required for the shaft enclosure. Doors shall be self- or automatic-closing upon the detection of smoke in accordance with Section 716.5.9.3. Refuse chutes shall not terminate in an incinerator room. Refuse, recycling and laundry rooms that are not provided with chutes need only comply with Table 509.

**713.13.5 Incinerator room.** Incinerator rooms shall comply with Table 509.

**713.13.6 Automatic sprinkler system.** An approved automatic sprinkler system shall be installed in accordance with Section 903.2.11.2.

**713.14 Elevator, dumbwaiter and other hoistways.** Elevator, dumbwaiter and other hoistway enclosures shall be constructed in accordance with Section 713 and Chapter 30.

**713.14.1 Elevator lobby.** An enclosed elevator lobby shall be provided at each floor where an elevator shaft enclosure connects more than *two stories in Group A, E, H, I, L, R-1, R-2 and R-2.1 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, and more than three stories for all other occupancies.* The lobby enclosure shall separate the elevator shaft enclosure doors from each floor by fire partitions. In addition to the requirements in Section 708 for fire partitions, doors protecting openings in the elevator lobby enclosure walls

shall also comply with Section 716.5.3 as required for corridor walls and penetrations of the elevator lobby enclosure by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1. Elevator lobbies shall have at least one means of egress complying with Chapter 10 and other provisions within this code.

**Exceptions:**

1. Enclosed elevator lobbies are not required at the level(s) of exit discharge, provided the level(s) of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Elevators not required to be located in a shaft in accordance with Section 712.1 are not required to have enclosed elevator lobbies.
3. Enclosed elevator lobbies are not required where additional doors are provided at the hoistway opening in accordance with Section 3002.6. Such doors shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.
4. Enclosed elevator lobbies are not required where the building is protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. This exception shall not apply to the following:
  - 4.1. *Group A occupancies;*
  - 4.2. *Group E occupancies;*
  - 4.3. *Group H occupancies;*
  - 4.4. *Group I occupancies;*
  - 4.5. *Group L occupancies;*
  - 4.6. *Group R-1, R-2, and R-2.1 occupancies; and*
  - 4.7. *High-rise buildings.*
5. Smoke partitions shall be permitted in lieu of fire partitions to separate the elevator lobby at each floor where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition to the requirements in Section 710 for smoke partitions, doors protecting openings in the smoke partitions shall also comply with Sections 710.5.2.2, 710.5.2.3, and 716.5.9 and duct penetrations of the smoke partitions shall be protected as required for corridors in accordance with Section 717.5.4.1.
6. *[SFM] When approved, in other than Group I-2 occupancies* enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance with Section 909.21.
7. Enclosed elevator lobbies are not required where the elevator serves only open parking garages in accordance with Section 406.5.

8. *[SFM] Enclosed elevator lobbies are not required where the hoistway door has a fire-protection rating as required by Section 708.7 and the hoistway door opening is also protected by a listed and labeled smoke containment system complying with ICC ES AC 77.*

*See Section 403.6 for additional requirements for highrise buildings.*

**713.14.1.1 Areas of refuge.** Areas of refuge shall be provided as required in Section 1007.

**SECTION 714  
PENETRATIONS**

\*

**714.1 Scope.** The provisions of this section shall govern the materials and methods of construction used to protect through penetrations and membrane penetrations of horizontal assemblies and fire-resistance-rated wall assemblies.

**714.1.1 Ducts and air transfer openings.** Penetrations of fire-resistance-rated walls by ducts that are not protected with dampers shall comply with Sections 714.2 through 714.3.3. Penetrations of horizontal assemblies not protected with a shaft as permitted by Section 717.6, and not required to be protected with fire dampers by other sections of this code, shall comply with Sections 714.4 through 714.4.2.2. Ducts and air transfer openings that are protected with dampers shall comply with Section 717.

**714.2 Installation details.** Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with this section. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with this section.

**714.3 Fire-resistance-rated walls.** Penetrations into or through fire walls, fire barriers, smoke barrier walls and fire partitions shall comply with Sections 714.3.1 through 714.3.3. Penetrations in smoke barrier walls shall also comply with Section 714.5.

**714.3.1 Through penetrations.** Through penetrations of fire-resistance-rated walls shall comply with Section 714.3.1.1 or 714.3.1.2.

**Exception:** Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space between the penetrating item and the fire-resistance-rated wall is permitted to be protected as follows:

1. In concrete or masonry walls where the penetrating item is a maximum 6-inch (152 mm) nominal diameter and the area of the opening through the wall does not exceed 144 square inches (0.0929 m<sup>2</sup>), concrete, grout or mortar is permitted where it is installed the full thickness of the wall or the thickness required to maintain the fire-resistance rating; or

2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 or UL 263 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

**714.3.1.1 Fire-resistance-rated assemblies.** Penetrations shall be installed as tested in an approved fire-resistance-rated assembly.

**714.3.1.2 Through-penetration firestop system.** Through penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an F rating of not less than the required fire-resistance rating of the wall penetrated.

**714.3.2 Membrane penetrations.** Membrane penetrations shall comply with Section 714.3.1. Where walls or partitions are required to have a fire-resistance rating, recessed fixtures shall be installed such that the required fire-resistance will not be reduced.

**Exceptions:**

1. Membrane penetrations of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m<sup>2</sup>) in area, provided the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m<sup>2</sup>) in any 100 square feet (9.29 m<sup>2</sup>) of wall area. The annular space between the wall membrane and the box shall not exceed  $\frac{1}{8}$  inch (3.1 mm). Such boxes on opposite sides of the wall or partition shall be separated by one of the following:
  - 1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities;
  - 1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
  - 1.3. By solid fireblocking in accordance with Section 718.2.1;
  - 1.4. By protecting both outlet boxes with listed putty pads; or
  - 1.5. By other listed materials and methods.
2. Membrane penetrations by listed electrical boxes of any material, provided such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not

exceed  $\frac{1}{8}$  inch (3.1 mm) unless listed otherwise. Such boxes on opposite sides of the wall or partition shall be separated by one of the following:

- 2.1. By the horizontal distance specified in the listing of the electrical boxes;
  - 2.2. By solid fireblocking in accordance with Section 718.2.1;
  - 2.3. By protecting both boxes with listed putty pads; or
  - 2.4. By other listed materials and methods.
3. Membrane penetrations by electrical boxes of any size or type, which have been listed as part of a wall opening protective material system for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.
  4. Membrane penetrations by boxes other than electrical boxes, provided such penetrating items and the annular space between the wall membrane and the box, are protected by an approved membrane penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water, and shall have an F and T rating of not less than the required fire-resistance rating of the wall penetrated and be installed in accordance with their listing.
  5. The annular space created by the penetration of an automatic sprinkler, provided it is covered by a metal escutcheon plate.

**714.3.3 Dissimilar materials.** Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the wall is maintained.

**714.4 Horizontal assemblies.** Penetrations of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly not required to be enclosed in a shaft by Section 712.1 shall be protected in accordance with Sections 714.4.1 through 714.4.2.2.

**714.4.1 Fire-resistance-rated assemblies.** Penetrations of the fire-resistance-rated floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall comply with Sections 714.4.1.1 through 714.4.1.4. Penetrations in horizontal smoke barriers shall also comply with 714.5.

**714.4.1.1 Through penetrations.** Through penetrations of fire-resistance-rated horizontal assemblies shall comply with Section 714.4.1.1.1 or 714.4.1.1.2.

**Exceptions:**

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes or vents or concrete or masonry items through a single fire-resistance-rated floor assembly where the annular space is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to

ASTM E 119 or UL 263 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated. Penetrating items with a maximum 6-inch (152 mm) nominal diameter shall not be limited to the penetration of a single fire-resistance-rated floor assembly, provided the aggregate area of the openings through the assembly does not exceed 144 square inches (92 900 mm<sup>2</sup>) in any 100 square feet (9.3 m<sup>2</sup>) of floor area.

2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes or vents with a maximum 6-inch (152 mm) nominal diameter, provided the concrete, grout or mortar is installed the full thickness of the floor or the thickness required to maintain the fire-resistance rating. The penetrating items shall not be limited to the penetration of a single concrete floor, provided the area of the opening through each floor does not exceed 144 square inches (92 900 mm<sup>2</sup>).
3. Penetrations by listed electrical boxes of any material, provided such boxes have been tested for use in fire-resistance-rated assemblies and installed in accordance with the instructions included in the listing.

**714.4.1.1.1 Installation.** Through penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

**714.4.1.1.2 Through-penetration firestop system.** Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (2.49 Pa). The system shall have an F rating/T rating of not less than 1 hour but not less than the required rating of the floor penetrated.

**Exceptions:**

1. Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a T rating.
2. Floor penetrations by floor drains, tub drains or shower drains contained and located within the concealed space of a horizontal assembly do not require a T rating.

**714.4.1.2 Membrane penetrations.** Penetrations of membranes that are part of a horizontal assembly shall comply with Section 714.4.1.1.1 or 714.4.1.1.2. Where floor/ceiling assemblies are required to have a fire-resistance rating, recessed fixtures shall be installed

such that the required fire resistance will not be reduced.

**Exceptions:**

1. Membrane penetrations by steel, ferrous or copper conduits, pipes, tubes or vents, or concrete or masonry items where the annular space is protected either in accordance with Section 714.4.1.1 or to prevent the free passage of flame and the products of combustion. The aggregate area of the openings through the membrane shall not exceed 100 square inches (64 500 mm<sup>2</sup>) in any 100 square feet (9.3 m<sup>2</sup>) of ceiling area in assemblies tested without penetrations.
2. Ceiling membrane penetrations of maximum 2-hour horizontal assemblies by steel electrical boxes that do not exceed 16 square inches (10 323 mm<sup>2</sup>) in area, provided the aggregate area of such penetrations does not exceed 100 square inches (64 500 mm<sup>2</sup>) in any 100 square feet (9.29 m<sup>2</sup>) of ceiling area, and the annular space between the ceiling membrane and the box does not exceed  $\frac{1}{8}$  inch (3.2 mm).
3. Membrane penetrations by electrical boxes of any size or type, which have been listed as part of an opening protective material system for use in horizontal assemblies and are installed in accordance with the instructions included in the listing.
4. Membrane penetrations by listed electrical boxes of any material, provided such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the ceiling membrane and the box shall not exceed  $\frac{1}{8}$  inch (3.2 mm) unless listed otherwise.
5. The annular space created by the penetration of a fire sprinkler, provided it is covered by a metal escutcheon plate.
6. Noncombustible items that are cast into concrete building elements and that do not penetrate both top and bottom surfaces of the element.
7. The ceiling membrane of 1- and 2-hour fire-resistance-rated horizontal assemblies is permitted to be interrupted with the double wood top plate of a fire-resistance-rated wall assembly, provided that all penetrating items through the double top plates are protected in accordance with Section 714.4.1.1.1 or 714.4.1.1.2. The fire-resistance rating of the wall shall not be less than the rating of the horizontal assembly.

**714.4.1.3 Dissimilar materials.** Noncombustible penetrating items shall not connect to combustible materials beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the horizontal assembly is maintained.

**714.4.2 Nonfire-resistance-rated assemblies.** Penetrations of nonfire-resistance-rated floor or floor/ceiling assemblies or the ceiling membrane of a nonfire-resistance-rated roof/ceiling assembly shall meet the requirements of Section 713 or shall comply with Section 714.4.2.1 or 714.4.2.2.

**714.4.2.1 Noncombustible penetrating items.** Noncombustible penetrating items that connect not more than five stories are permitted, provided that the annular space is filled to resist the free passage of flame and the products of combustion with an approved noncombustible material or with a fill, void or cavity material that is tested and classified for use in through-penetration firestop systems.

**714.4.2.2 Penetrating items.** Penetrating items that connect not more than two stories are permitted, provided that the annular space is filled with an approved material to resist the free passage of flame and the products of combustion.

**714.5 Penetrations in smoke barriers.** Penetrations in smoke barriers shall be protected by an approved through-penetration firestop system installed and tested in accordance with the requirements of UL 1479 for air leakage. The L rating of the system measured at 0.30 inch (7.47 Pa) of water in both the ambient temperature and elevated temperature tests, shall not exceed:

1. 5.0 cfm per square foot ( $0.025 \text{ m}^3 / \text{s} \cdot \text{m}^2$ ) of penetration opening for each through-penetration firestop system; or
2. A total cumulative leakage of 50 cfm ( $0.024 \text{ m}^3/\text{s}$ ) for any 100 square feet ( $9.3 \text{ m}^2$ ) of wall area, or floor area.

## SECTION 715 FIRE-RESISTANT JOINT SYSTEMS

**715.1 General.** Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which it is installed. Fire-resistant joint systems shall be tested in accordance with Section 715.3.

**Exception:** Fire-resistant joint systems shall not be required for joints in all of the following locations:

1. Floors within a single dwelling unit.
2. Floors where the joint is protected by a shaft enclosure in accordance with Section 713.
3. Floors within atriums where the space adjacent to the atrium is included in the volume of the atrium for smoke control purposes.

4. Floors within malls.
5. Floors and ramps within open and enclosed parking garages or structures constructed in accordance with Sections 406.5 and 406.6, respectively.
6. Mezzanine floors.
7. Walls that are permitted to have unprotected openings.
8. Roofs where openings are permitted.
9. Control joints not exceeding a maximum width of 0.625 inch (15.9 mm) and tested in accordance with ASTM E 119 or UL 263.

**715.1.1 Curtain wall assembly.** The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 715.4.

**715.2 Installation.** A fire-resistant joint system shall be securely installed in accordance with the listing criteria in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases.

**715.3 Fire test criteria.** Fire-resistant joint systems shall be tested in accordance with the requirements of either ASTM E 1966 or UL 2079. Nonsymmetrical wall joint systems shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side.

**Exception:** For exterior walls with a horizontal fire separation distance greater than 5 feet (1524 mm), the joint system shall be required to be tested for interior fire exposure only.

**715.4 Exterior curtain wall/floor intersection.** Where fire resistance-rated floor or floor/ceiling assemblies are required, voids created at the intersection of the exterior curtain wall assemblies and such floor assemblies shall be sealed with an approved system to prevent the interior spread of fire. Such systems shall be securely installed and tested in accordance with ASTM E 2307 to provide an F rating for a time period at least equal to the fire-resistance rating of the floor assembly. Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 705.8.5.

**Exception:** Voids created at the intersection of the exterior curtain wall assemblies and such floor assemblies where the vision glass extends to the finished floor level shall be permitted to be sealed with an approved material to prevent the interior spread of fire. Such material shall be securely installed and capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (0.254 mm) of water column (2.5 Pa) for the

time period at least equal to the fire-resistance rating of the floor assembly.

**715.4.1 Exterior curtain wall/nonfire-resistance-rated floor assembly intersections.** Voids created at the intersection of exterior curtain wall assemblies and nonfire-resistance-rated floor or floor/ceiling assemblies shall be sealed with an approved material or system to retard the interior spread of fire and hot gases between stories.

**715.5 Spandrel wall.** Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 705.8.5. Where Section 705.8.5 does not require a fire-resistance-rated spandrel wall, the requirements of Section 715.4 shall still apply to the intersection between the spandrel wall and the floor.

**715.6 Fire-resistant joint systems in smoke barriers.** Fire-resistant joint systems in smoke barriers, and joints at the intersection of a horizontal smoke barrier and an exterior curtainwall, shall be tested in accordance with the requirements of UL 2079 for air leakage. The *L* rating of the joint system shall not exceed 5 cfm per linear foot (0.00775 m<sup>3</sup>/s m) of joint at 0.30 inch (7.47 Pa) of water for both the ambient temperature and elevated temperature tests.

## SECTION 716 OPENING PROTECTIVES

**716.1 General.** Opening protectives required by other sections of this code shall comply with the provisions of this section.

**716.2 Fire-resistance-rated glazing.** Fire-resistance-rated glazing tested as part of a fire-resistance-rated wall assembly in accordance with ASTM E 119 or UL 263 and labeled in accordance with Section 703.5 shall be permitted in fire doors and fire window assemblies where tested and installed in accordance with their listings and shall not otherwise be required to comply with this section.

**716.3 Marking fire-rated glazing assemblies.** Fire-rated glazing assemblies shall be marked in accordance with Tables 716.3, 716.5, and 716.6.

**716.3.1 Fire-rated glazing that exceeds the code requirements.** Fire-rated glazing assemblies marked as

complying with hose stream requirements (H) shall be permitted in applications that do not require compliance with hose stream requirements. Fire-rated glazing assemblies marked as complying with temperature rise requirements (T) shall be permitted in applications that do not require compliance with temperature rise requirements. Fire-rated glazing assemblies marked with ratings (XXX) that exceed the ratings required by this code shall be permitted.

**716.4 Alternative methods for determining fire protection ratings.** The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in NFPA 252, NFPA 257 or UL 9. The required fire resistance of an opening protective shall be permitted to be established by any of the following methods or procedures:

1. Designs documented in approved sources.
2. Calculations performed in an approved manner.
3. Engineering analysis based on a comparison of opening protective designs having fire protection ratings as determined by the test procedures set forth in NFPA 252, NFPA 257 or UL 9.
4. Alternative protection methods as allowed by Section 104.11.

**716.5 Fire door and shutter assemblies.** Approved fire door and fire shutter assemblies shall be constructed of any material or assembly of component materials that conforms to the test requirements of Section 716.5.1, 716.5.2 or 716.5.3 and the fire protection rating indicated in Table 716.5. Fire door frames with transom lights, sidelights or both shall be permitted in accordance with Section 716.5.6. Fire door assemblies and shutters shall be installed in accordance with the provisions of this section and NFPA 80.

### Exceptions:

1. Labeled protective assemblies that conform to the requirements of this section or UL 10A, UL 14B and UL 14C for tin-clad fire door assemblies.
2. Floor fire door assemblies in accordance with Section 711.8.

TABLE 716.3  
MARKING FIRE-RATED GLAZING ASSEMBLIES

FIRE TEST STANDARD	MARKING	DEFINITION OF MARKING
ASTM E 119 or UL 263	W	Meets wall assembly criteria.
NFPA 257 or UL 9	OH	Meets fire window assembly criteria including the hose stream test.
NFPA 252 or UL 10B or UL 10C	D	Meets fire door assembly criteria.
	H	Meets fire door assembly "Hose Stream" test.
	T	Meets 450°F temperature rise criteria for 30 minutes
	XXX	The time in minutes of the fire resistance or fire protection rating of the glazing assembly

For SI: °C = [(°F) - 32]/1.8.



**716.5.1 Side-hinged or pivoted swinging doors.** Fire door assemblies with side-hinged and pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C. After 5 minutes into the NFPA 252 test, the neutral pressure level in the furnace shall be established at 40 inches (1016 mm) or less above the sill.

**716.5.2 Other types of assemblies.** Fire door assemblies with other types of doors, including swinging elevator doors and fire shutter assemblies, bottom and side-hinged chute intake doors, and top-hinged chute discharge doors, shall be tested in accordance with NFPA 252 or UL 10B. The pressure in the furnace shall be maintained as nearly equal to the atmospheric pressure as possible. Once established, the pressure shall be maintained during the entire test period.

**716.5.3 Door assemblies in corridors and smoke barriers.** Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in corridor walls or smoke barrier walls having a fire-resistance rating in accordance with Table 716.5 shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.

**Exceptions:**

1. Viewports that require a hole not larger than 1 inch (25 mm) in diameter through the door, have at least a 0.25-inch-thick (6.4 mm) glass disc and the holder is of metal that will not melt out where subject to temperatures of 1,700°F (927°C).
2. Corridor door assemblies in occupancies of Group I-2 shall be in accordance with Section 407.3.1.
3. Unprotected openings shall be permitted for corridors in multitheater complexes where each motion picture auditorium has at least one-half of its required exit or exit access doorways opening directly to the exterior or into an exit passageway.
4. Horizontal sliding doors in smoke barriers that comply with Sections 408.3 and 408.8.1 in occupancies in Group I-3.
5. *Cell or room doors, including cell or room doors with integral side-lites that are part of the door assembly in Group I-3 occupancies which open into a required exit corridor within a cell complex.*

**716.5.3.1 Smoke and draft control.** Fire door assemblies shall also meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot ( $0.01524 \text{ m}^3/\text{s} \cdot \text{m}^2$ ) of door opening at 0.10 inch

(24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited. Installation of smoke doors shall be in accordance with NFPA 105.

**716.5.3.2 Glazing in door assemblies.** In a 20-minute fire door assembly, the glazing material in the door itself shall have a minimum fire-protection-rated glazing of 20 minutes and shall be exempt from the hose stream test. Glazing material in any other part of the door assembly, including transom lights and sidelights, shall be tested in accordance with NFPA 257 or UL 9, including the hose stream test, in accordance with Section 716.6.

**716.5.4 Door assemblies in other fire partitions.** Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in other fire partitions having a fire-resistance rating of 0.5 hour in accordance with Table 716.5 shall be tested in accordance with NFPA 252, UL 10B or UL 10C with the hose stream test.

**716.5.5 Doors in interior exit stairways and ramps and exit passageways.** Fire door assemblies in interior exit stairways and ramps and exit passageways shall have a maximum transmitted temperature rise of not more than 450°F (250°C) above ambient at the end of 30 minutes of standard fire test exposure.

**Exception:** The maximum transmitted temperature rise is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

**716.5.5.1 Glazing in doors.** Fire-protection-rated glazing in excess of 100 square inches ( $0.065 \text{ m}^2$ ) is not permitted. Fire-resistance-rated glazing in excess of 100 square inches ( $0.065 \text{ m}^2$ ) shall be permitted in fire door assemblies when tested as components of the door assemblies, and not as glass lights, and shall have a maximum transmitted temperature rise of 450°F (250°C) in accordance with Section 716.5.5.

**716.5.6 Fire door frames with transom lights and sidelights.** Door frames with transom lights, sidelights, or both, shall be permitted where a  $3/4$ -hour fire protection rating or less is required in accordance with Table 716.5. Fire door frames with transom lights, sidelights, or both, installed with fire-resistance-rated glazing tested as an assembly in accordance with ASTM E 119 or UL 263 shall be permitted where a fire protection rating exceeding  $3/4$  hour is required in accordance with Table 716.5.

**716.5.7 Labeled protective assemblies.** Fire door assemblies shall be labeled by an approved agency. The labels shall comply with NFPA 80, and shall be permanently affixed to the door or frame.

**TABLE 716.5  
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS**

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE	FIRE RATED GLAZING MARKING DOOR VISION PANEL °	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4	3	Not Permitted	Not Permitted	Not Permitted	4	Not Permitted	W-240
	3	3 <sup>a</sup>	Not Permitted	Not Permitted	Not Permitted	3	Not Permitted	W-180
	2	1½	100 sq. in. <sup>c</sup>	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	2	Not Permitted	W-120
	1½	1½	100 sq. in. <sup>c</sup>	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	1½	Not Permitted	W-90
Shaft, exit enclosures and exit passageway walls	2	1½	100 sq. in. <sup>c,d</sup>	≤100 sq.in. = D-H-90 > 100 sq.in.= D-H-T-or D-H-T-W-90	Not Permitted	2	Not Permitted	W-120
Fire barriers having a required fire-resistance rating of 1 hour: Enclosures for shafts, exit access stairways, exit access ramps, interior exit stairways, interior exit ramps and exit passageway walls	1	1	100 sq. in. <sup>c,d</sup>	≤100 sq.in. = D-H-60 >100 sq.in.= D-H-T-60 or D-H-T-W-60	Not Permitted	1	Not Permitted	W-60
					<b>Fire protection</b>			
Other fire barriers	1	¾	Maximum size tested	D-H-NT-45	¾		D-H-NT-45	
Fire partitions: Corridor walls	1	⅓ <sup>b</sup>	Maximum size tested	D-20	¾ <sup>b</sup>		D-H-OH-45	
	0.5	⅓ <sup>b</sup>	Maximum size tested	D-20	⅓		D-H-OH-20	
Other fire partitions	1	¾	Maximum size tested	D-H-45	¾		D-H-45	
	0.5	⅓	Maximum size tested	D-H-20	⅓		D-H-20	

(continued)

**TABLE 716.5—continued**  
**OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS**

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE	FIRE RATED GLAZING MARKING DOOR VISION PANEL <sup>e</sup>	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Exterior walls	3	1½	100 sq. in. <sup>c</sup>	≤100 sq.in. = D-H-90 >100 sq.in = D-H-W-90	Not Permitted	3	Not Permitted	W-180
	2	1½	100 sq. in. <sup>c</sup>	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	2	Not Permitted	W-120
					<b>Fire Protection</b>			
	1	¾	Maximum size tested	D-H-45	¾		D-H-45	
Smoke barriers					<b>Fire protection</b>			
	1	⅓ <sup>b</sup>	Maximum size tested	D-20	¾		D-H-OH-45	

For SI: 1 square inch = 645.2 mm.

- Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
- For testing requirements, see Section 716.6.3.
- Fire-resistance-rated glazing tested to ASTM E 119 in accordance with Section 716.2 shall be permitted, in the maximum size tested.
- Except where the building is equipped throughout with an automatic sprinkler and the fire-rated glazing meets the criteria established in Section 716.5.5.
- Under the column heading "Fire-rated glazing marking door vision panel," W refers to the fire-resistance rating of the glazing, not the frame.

**716.5.7.1 Fire door labeling requirements.** Fire doors shall be labeled showing the name of the manufacturer or other identification readily traceable back to the manufacturer, the name or trademark of the third-party inspection agency, the fire protection rating and, where required for fire doors in interior exit stairways and ramps and exit passageways by Section 716.5.5, the maximum transmitted temperature end point. Smoke and draft control doors complying with UL 1784 shall be labeled as such and shall also comply with Section 716.5.7.3. Labels shall be approved and permanently affixed. The label shall be applied at the factory or location where fabrication and assembly are performed.

***Exception:** In Group I-3 doors that are required to be 45 minutes or higher shall be fire-rated assemblies or certified by the manufacturer as being equivalent to the required standard.*

**716.5.7.1.1 Light kits, louvers and components.** Listed light kits and louvers and their required preparations shall be considered as part of the labeled door where such installations are done under the listing program of the third-party agency. Where tested for such use, fire doors and door assemblies shall be permitted to consist of components, including glazing, vision light kits and hardware that are labeled, listed or classified by different third-party agencies.

**716.5.7.2 Oversized doors.** Oversized fire doors shall bear an oversized fire door label by an approved agency or shall be provided with a certificate of inspection furnished by an approved testing agency. When a certificate of inspection is furnished by an approved testing agency, the certificate shall state that the door conforms

to the requirements of design, materials and construction, but has not been subjected to the fire test.

**716.5.7.3 Smoke and draft control door labeling requirements.** Smoke and draft control doors complying with UL 1784 shall be labeled in accordance with Section 716.5.6.1 and shall show the letter "S" on the fire-rating label of the door. This marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.

**716.5.7.4 Fire door frame labeling requirements.** Fire door frames shall be labeled showing the names of the manufacturer and the third-party inspection agency.

**716.5.8 Glazing material.** Fire-protection-rated glazing conforming to the opening protection requirements in Section 716.5 shall be permitted in fire door assemblies.

**716.5.8.1 Size limitations.** Fire-protection-rated glazing shall comply with the size limitations of NFPA 80, and as provided in Sections 716.5.8.1.1 and 716.5.8.1.2.

**716.5.8.1.1 Fire-resistance-rated glazing in door assemblies in fire walls and fire barriers rated greater than 1 hour.** Fire-resistance-rated glazing tested to ASTM E 119 or UL 263 and NFPA 252, UL 10B or UL 10C shall be permitted in fire door assemblies located in fire walls and in fire barriers in accordance with Table 716.5 to the maximum size tested and in accordance with their listings.

**716.5.8.1.2 Fire-protection-rated glazing in door assemblies in fire walls and fire barriers rated greater than 1 hour.** Fire-protection-rated glazing shall be prohibited in fire walls and fire barriers

except as provided in Sections 716.5.8.1.2.1 and 716.5.8.1.2.2.

**716.5.8.1.2.1 Horizontal exits.** Fire-protection-rated glazing shall be permitted as vision panels in self-closing swinging fire door assemblies serving as horizontal exits in fire walls where limited to 100 square inches (0.065 m<sup>2</sup>) with no dimension exceeding 10 inches (0.3 mm).

**716.5.8.1.2.2 Fire barriers.** Fire-protection-rated glazing shall be permitted in fire doors having a 1½-hour fire protection rating intended for installation in fire barriers, where limited to 100 square inches (0.065 m<sup>2</sup>).

**716.5.8.2 Elevator, stairway and ramp protectives.**

Approved fire-protection-rated glazing used in fire door assemblies in elevator, stairways and ramps enclosures shall be so located as to furnish clear vision of the passageway or approach to the elevator, stairway or ramp.

**716.5.8.3 Labeling.** Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in Section 716.5.8.3.1 that shall be issued by an approved agency and shall be permanently identified on the glazing.

**716.5.8.3.1 Identification.** For fire-protection-rated glazing, the label shall bear the following four-part identification: “D - H or NH - T or NT - XXX.” “D” indicates that the glazing shall be used in fire door assemblies and that the glazing meets the fire protection requirements of NFPA 252. “H” shall indicate that the glazing meets the hose stream requirements of NFPA 252. “NH” shall indicate that the glazing does not meet the hose stream requirements of the test. “T” shall indicate that the glazing meets the temperature requirements of Section 716.5.5.1. “NT” shall indicate that the glazing does not meet the temperature requirements of Section 716.5.5.1. The placeholder “XXX” shall specify the fire-protection-rating period, in minutes.

**716.5.8.4 Safety glazing.** Fire-protection-rated glazing installed in fire doors in areas subject to human impact in hazardous locations shall comply with Chapter 24.

**716.5.9 Door closing.** Fire doors shall be self- or automatic-closing in accordance with this section. Self-closing chute intake doors shall not fail in a “door open” position in the event of a closer failure.

**Exceptions:**

1. Fire doors located in common walls separating sleeping units in Group R-1 shall be permitted without automatic- or self-closing devices.
2. The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I emergency recall operation.

**716.5.9.1 Latch required.** Unless otherwise specifically permitted, single fire doors and both leaves of pairs of side-hinged swinging fire doors shall be provided with an active latch bolt that will secure the door when it is closed.

**716.5.9.1.1 Chute intake door latching.** Chute intake doors shall be positive latching, remaining latched and closed in the event of latch spring failure during a fire emergency.

**716.5.9.2 Automatic-closing fire door assemblies.** Automatic-closing fire door assemblies shall be self-closing in accordance with NFPA 80.

**716.5.9.3 Smoke-activated doors.** Automatic-closing doors installed in the following locations shall be automatic-closing by the actuation of smoke detectors installed in accordance with Section 907.3 or by loss of power to the smoke detector or hold-open device. Doors that are automatic-closing by smoke detection shall not have more than a 10-second delay before the door starts to close after the smoke detector is actuated:

1. Doors installed across a corridor.
2. Doors that protect openings in exits or corridors required to be of fire-resistance-rated construction.
3. Doors that protect openings in walls that are capable of resisting the passage of smoke in accordance with Section 509.4.
4. Doors installed in smoke barriers in accordance with Section 709.5.
5. Doors installed in fire partitions in accordance with Section 708.6.
6. Doors installed in a fire wall in accordance with Section 706.8.
7. Doors installed in shaft enclosures in accordance with Section 713.7.
8. Doors installed in refuse and laundry chutes and access and termination rooms in accordance with Section 713.13. Automatic-closing chute intake doors installed in refuse and laundry chutes shall also meet the requirements of Sections 716.5.9 and 716.5.9.1.1.
9. Doors installed in the walls for compartmentation of underground buildings in accordance with Section 405.4.2.
10. Doors installed in the elevator lobby walls of underground buildings in accordance with Section 405.4.3.
11. Doors installed in smoke partitions in accordance with Section 710.5.2.3.
12. *[SFM] Doors installed in walls required to be fire rated in accordance with Section 509.4.*
13. *[SFM] Doors installed in walls required to be fire rated in accordance with Section 508.4.*

*In Group I-2 occupancies smoke activated doors installed in the above locations shall be automatic closing by actuation of the fire alarm system, or actuation of smoke detectors installed in accordance with Section 907.10, or activation of the sprinkler system installed in accordance with Section 903.1.*

**716.5.9.4 Doors in pedestrian ways.** Vertical sliding or vertical rolling steel fire doors in openings through which pedestrians travel shall be heat activated or activated by smoke detectors with alarm verification.

**716.5.10 Swinging fire shutters.** Where fire shutters of the swinging type are installed in exterior openings, not less than one row in every three vertical rows shall be arranged to be readily opened from the outside, and shall be identified by distinguishing marks or letters not less than 6 inches (152 mm) high.

**716.5.11 Rolling fire shutters.** Where fire shutters of the rolling type are installed, such shutters shall include approved automatic-closing devices.

**716.6 Fire-protection-rated glazing.** Glazing in fire window assemblies shall be fire protection rated in accordance with this section and Table 716.6. Glazing in fire door assemblies shall comply with Section 716.5.8. Fire-protection-rated glazing in fire window assemblies shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257 or UL 9. Fire-protection-rated glazing shall also comply with NFPA 80. Openings in nonfire-resistance-rated exterior wall assemblies that require protection in accordance with Section 705.3, 705.8, 705.8.5 or 705.8.6 shall have a fire protection rating of not less than ¾ hour. Fire-protection-rated glazing in 0.5-hour fire-resistance-rated partitions is permitted to have a 0.33-hour fire protection rating.

**716.6.1 Testing under positive pressure.** NFPA 257 or UL 9 shall evaluate fire-protection-rated glazing under positive pressure. Within the first 10 minutes of a test, the

pressure in the furnace shall be adjusted so at least two-thirds of the test specimen is above the neutral pressure plane, and the neutral pressure plane shall be maintained at that height for the balance of the test.

**716.6.2 Nonsymmetrical glazing systems.** Nonsymmetrical fire-protection-rated glazing systems in fire partitions, fire barriers or in exterior walls with a fire separation distance of 5 feet (1524 mm) or less pursuant to Section 705 shall be tested with both faces exposed to the furnace, and the assigned fire protection rating shall be the shortest duration obtained from the two tests conducted in compliance with NFPA 257 or UL 9.

**716.6.3 Safety glazing.** Fire-protection-rated glazing installed in fire window assemblies in areas subject to human impact in hazardous locations shall comply with Chapter 24.

**716.6.4 Glass and glazing.** Glazing in fire window assemblies shall be fire-protection-rated glazing installed in accordance with and complying with the size limitations set forth in NFPA 80.

**716.6.5 Installation.** Fire-protection-rated glazing shall be in the fixed position or be automatic-closing and shall be installed in approved frames.

**716.6.6 Window mullions.** Metal mullions that exceed a nominal height of 12 feet (3658 mm) shall be protected with materials to afford the same fire-resistance rating as required for the wall construction in which the protective is located.

**716.6.7 Interior fire window assemblies.** Fire-protection-rated glazing used in fire window assemblies located in fire partitions and fire barriers shall be limited to use in assemblies with a maximum fire-resistance rating of 1 hour in accordance with this section.

TABLE 716.6  
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS

TYPE OF WALL ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)	FIRE-RATED GLAZING MARKING
Interior walls			
Fire walls	All	NP <sup>a</sup>	W-XXX <sup>b</sup>
Fire barriers	>1	NP <sup>a</sup>	W-XXX <sup>b</sup>
	1	NP <sup>a</sup>	W-XXX <sup>b</sup>
Incidental use areas (707.3.6), Mixed occupancy separations (707.3.8)	1	¾	OH-45 or W-60
Fire partitions	1	¾	OH-45 or W-60
	0.5	⅓	OH-20 or W-30
Smoke barriers	1	¾	OH-45 or W-60
Exterior walls	>1	1½	OH-90 or W-XXX <sup>b</sup>
	1	¾	OH-45 or W-60
	0.5	⅓	OH-20 or W-30
Party wall	All	NP	Not Applicable

NP = Not Permitted.

a. Not permitted except fire-resistance-rated glazing assemblies tested to ASTM E 119 or UL 263, as specified in Section 716.2.

b. XXX = The fire rating duration period in minutes, which shall be equal to the fire-resistance rating required for the wall assembly.

**716.6.7.1 Where  $\frac{3}{4}$ -hour fire protection window assemblies permitted.** Fire-protection-rated glazing requiring 45-minute opening protection in accordance with Table 716.6 shall be limited to fire partitions designed in accordance with Section 708 and fire barriers utilized in the applications set forth in Sections 707.3.6 and 707.3.8 where the fire-resistance rating does not exceed 1 hour. Fire-resistance-rated glazing assemblies tested in accordance with ASTM E 119 or UL 263 shall not be subject to the limitations of this section.

**716.6.7.2 Area limitations.** The total area of the glazing in fire-protection-rated windows assemblies shall not exceed 25 percent of the area of a common wall with any room.

**716.6.7.3 Where  $\frac{1}{3}$ -hour fire-protection window assemblies permitted.** Fire-protection-rated glazing shall be permitted in window assemblies tested to NFPA 257 or UL 9 in smoke barriers and fire partitions requiring  $\frac{1}{3}$ -hour opening protection in accordance with Table 716.6.

**716.6.8 Labeling requirements.** Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in Table 716.6 that shall be issued by an approved agency and shall be permanently identified on the glazing.

## SECTION 717

### DUCTS AND AIR TRANSFER OPENINGS

**717.1 General.** The provisions of this section shall govern the protection of duct penetrations and air transfer openings in assemblies required to be protected and duct penetrations in nonfire-resistance-rated floor assemblies.

**717.1.1 Ducts that penetrate fire-resistance-rated assemblies without dampers.** Ducts that penetrate fire-resistance-rated assemblies and are not required by this section to have dampers shall comply with the requirements of Sections 714.2 through 714.3.3. Ducts that penetrate horizontal assemblies not required to be contained within a shaft and not required by this section to have dampers shall comply with the requirements of Sections 714.4 through 714.4.2.2.

**717.1.1.1 Ducts that penetrate nonfire-resistance-rated assemblies.** The space around a duct penetrating a nonfire-resistance-rated floor assembly shall comply with Section 717.6.3.

**717.2 Installation.** Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of this section, the manufacturer's installation instructions and the dampers' listing.

**717.2.1 Smoke control system.** Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized. Where

mechanical systems including ducts and dampers utilized for normal building ventilation serve as part of the smoke control system, the expected performance of these systems in smoke control mode shall be addressed in the rational analysis required by Section 909.4.

**717.2.2 Hazardous exhaust ducts.** Fire dampers for hazardous exhaust duct systems shall comply with the *California Mechanical Code*.

**717.3 Damper testing, ratings and actuation.** Damper testing, ratings and actuation shall be in accordance with Sections 717.3.1 through 717.3.3.

**717.3.1 Damper testing.** Dampers shall be listed and labeled in accordance with the standards in this section. Fire dampers shall comply with the requirements of UL 555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C or shall be tested as part of a fire-resistance-rated floor/ceiling or roof/ceiling assembly in accordance with ASTM E119 or UL 263.

**717.3.2 Damper rating.** Damper ratings shall be in accordance with Sections 717.3.2.1 through 717.3.2.3.

**717.3.2.1 Fire damper ratings.** Fire dampers shall have the minimum fire protection rating specified in Table 717.3.2.1 for the type of penetration.

**TABLE 717.3.2.1  
FIRE DAMPER RATING**

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

**717.3.2.2 Smoke damper ratings.** Smoke damper leakage ratings shall be Class I or II. Elevated temperature ratings shall not be less than 250°F (121°C).

**717.3.2.3 Combination fire/smoke damper ratings.** Combination fire/smoke dampers shall have the minimum fire protection rating specified for fire dampers in Table 717.3.2.1 for the type of penetration and shall also have a minimum smoke damper rating as specified in Section 717.3.2.2.

**717.3.3 Damper actuation.** Damper actuation shall be in accordance with Sections 717.3.3.1 through 717.3.3.4 as applicable.

**717.3.3.1 Fire damper actuation device.** The fire damper actuation device shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

2. The operating temperature shall be not more than 350°F (177°C) where located in a smoke control system complying with Section 909.

**717.3.3.2 Smoke damper actuation.** The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section 907.3 and one of the following methods, as applicable:

1. Where a smoke damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a smoke damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a smoke damper is installed within an air transfer opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.
4. Where a smoke damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within areas served by a heating, ventilation and air-conditioning (HVAC) system, smoke dampers shall be permitted to be controlled by the smoke detection system.

**717.3.3.3 Combination fire/smoke damper actuation.** Combination fire/smoke damper actuation shall be in accordance with Sections 717.3.3.1 and 717.3.3.2. Combination fire/smoke dampers installed in smoke control system shaft penetrations shall not be activated by local area smoke detection unless it is secondary to the smoke management system controls.

**717.3.3.4 Ceiling radiation damper actuation.** The operating temperature of a ceiling radiation damper actuation device shall be 50°F (27.8°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

**717.4 Access and identification.** Fire and smoke dampers shall be provided with an approved means of access, which is large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the

exterior by a label having letters not less than 1/2 inch (12.7 mm) in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

**717.5 Where required.** Fire dampers, smoke dampers and combination fire/smoke dampers shall be provided at the locations prescribed in Sections 717.5.1 through 717.5.7 and 717.6. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

**717.5.1 Fire walls.** Ducts and air transfer openings permitted in fire walls in accordance with Section 706.11 shall be protected with listed fire dampers installed in accordance with their listing.

**717.5.1.1 Horizontal exits.** A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a fire wall that serves as a horizontal exit.

**717.5.2 Fire barriers.** *In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal.* Ducts and air transfer openings of fire barriers shall be protected with approved fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate enclosures for stairways, ramps and exit passageways except as permitted by Sections 1022.4 and 1023.6, respectively.

**Exception:** Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E 119 or UL 263 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire damper would interfere with the operation of a smoke control system.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

*[SFM] For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, ducts and air transfer openings of fire barriers shall be protected with approved fire and smoke dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate exit enclo-*

*tures and exit passageways except as permitted by Sections 1022.4 and 1023.6, respectively.*

**Exceptions:**

1. Fire dampers are not required at penetrations of fire barriers where penetrations are tested in accordance with ASTM E119 as part of the fire-resistance rated assembly.
2. Fire and smoke dampers are not required where ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire or smoke damper would interfere with the operation of a smoke control system.

**717.5.2.1 Horizontal exits.** A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a fire barrier that serves as a horizontal exit.

**717.5.3 Shaft enclosures.** Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with approved fire and smoke dampers installed in accordance with their listing.

**Exceptions:**

1. Fire dampers are not required at penetrations of shafts where:
  - 1.1. Steel exhaust subducts are extended at least 22 inches (559 mm) vertically in exhaust shafts, provided there is a continuous airflow upward to the outside; or
  - 1.2. Penetrations are tested in accordance with ASTM E 119 or UL 263 as part of the fire-resistance-rated assembly; or
  - 1.3. Ducts are used as part of an approved smoke control system designed and installed in accordance with Section 909 and where the fire damper will interfere with the operation of the smoke control system; or
  - 1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
2. In Group B and R occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, smoke dampers are not required at penetrations of shafts where:
  - 2.1. Kitchen, clothes dryer, bathroom and toilet room exhaust openings are installed with steel exhaust subducts, having a minimum wall thickness of 0.0187-inch (0.4712 mm) (No. 26 gage);
  - 2.2. The subducts extend at least 22 inches (559 mm) vertically; and

- 2.3. An exhaust fan is installed at the upper terminus of the shaft that is powered continuously in accordance with the provisions of Section 909.11, so as to maintain a continuous upward airflow to the outside.

3. Smoke dampers are not required at penetration of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an approved mechanical smoke control system designed in accordance with Section 909 and where the smoke damper will interfere with the operation of the smoke control system.
5. Fire dampers and combination fire/smoke dampers are not required in kitchen and clothes dryer exhaust systems when installed in accordance with the *California Mechanical Code*.

**717.5.4 Fire partitions.** *In other than Group A, E, I and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listing.*

**Exceptions:** In occupancies other than Group H and L, fire dampers are not required where any of the following apply:

1. Corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and the duct is protected as a through penetration in accordance with Section 714.
2. Tenant partitions in covered and open mall buildings where the walls are not required by provisions elsewhere in the code to extend to the underside of the floor or roof sheathing, slab or deck above.
3. The duct system is constructed of approved materials in accordance with the *California Mechanical Code* and the duct penetrating the wall complies with all of the following requirements:
  - 3.1. The duct shall not exceed 100 square inches (0.06 m<sup>2</sup>).
  - 3.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.
  - 3.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
  - 3.4. The duct shall be installed above a ceiling.



- 3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.
- 3.6. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and the wall opening shall be filled with mineral wool batting on all sides.
4. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

*For Group A, E, I and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listings.*

**Exceptions:**

1. Fire dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness, protected as a through penetration in accordance with Section 713 and there are no openings serving the corridor.
2. Fire dampers are not required where the duct system is constructed of approved materials in accordance with the California Mechanical Code and the duct penetrating the wall complies with all of the following requirements:
  - 2.1. For other than corridors in Group I-2 occupancies the duct shall not exceed 100 square inches (0.6 m<sup>2</sup>).
  - 2.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.
  - 2.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
  - 2.4. The duct shall be installed above a ceiling.

- 2.5. The duct shall not terminate at a wall register in the fire-resistance rated wall.
- 2.6. The duct shall be protected as a through penetration in accordance with Section 714 or shall comply with the all of the following:
  1. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening.
  2. The sleeve shall be secured to both sides of the wall and for all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles.
  3. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws.
  4. The annular space between the steel sleeve and the wall opening shall be filled with mineral wool batting on all sides.

**717.5.4.1 Corridors.** *In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal a listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a corridor enclosure required to have smoke and draft control doors in accordance with Section 716.5.3.*

**Exceptions:**

1. Smoke dampers are not required where the building is equipped throughout with an approved smoke control system in accordance with Section 909, and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

**[SFM]** *For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, a listed smoke damper designed to resist the passage of smoke shall also be provided at each point a duct or air transfer opening penetrates a fire-resistance rated corridor enclosure required to have smoke and draft doors in accordance with Section 715.5.3.*

**Exceptions:**

1. Smoke dampers are not required where ducts are used as part of an approved mechanical smoke control system designed in accordance with Section 909 and where the smoke damper will interfere with the operation of the smoke control system.
2. Smoke damper are not required in corridor penetrations where the duct is constructed of steel not less

than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

**717.5.5 Smoke barriers.** A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier. Smoke dampers and smoke damper actuation methods shall comply with Section 717.3.3.2.

**Exception:** Smoke dampers are not required where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

**717.5.6 Exterior walls.** Ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings in accordance with Section 705.10 shall be protected with listed fire dampers installed in accordance with their listing.

**717.5.7 Smoke partitions.** A listed smoke damper designed to resist the passage of smoke shall be provided at each point that an air transfer opening penetrates a smoke partition. Smoke dampers and smoke damper actuation methods shall comply with Section 717.3.3.2.

**Exception:** Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.

**717.6 Horizontal assemblies.** Penetrations by ducts and air transfer openings of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section 713 or shall comply with Sections 717.6.1 through 717.6.3.

**717.6.1 Through penetrations.** In occupancies other than Groups I-2 and I-3, a duct constructed of approved materials in accordance with the *California Mechanical Code* that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection, provided a listed fire damper is installed at the floor line or the duct is protected in accordance with Section 714.4. For air transfer openings, see Section 712.1.8.

**Exception:** A duct is permitted to penetrate three floors or less without a fire damper at each floor, provided such duct meets all of the following requirements:

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel having a minimum wall thickness of 0.0187 inches (0.4712 mm) (No. 26 gage).
2. The duct shall open into only one dwelling or sleeping unit and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed 4-inch (102 mm) nominal diameter and the total area of such ducts shall not exceed 100 square inches (0.065 m<sup>2</sup>) in any 100 square feet (9.3 m<sup>2</sup>) of floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 or UL 263 time-

temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a listed ceiling radiation damper installed in accordance with Section 717.6.2.1.

**717.6.2 Membrane penetrations.** Ducts and air transfer openings constructed of approved materials in accordance with the *California Mechanical Code* that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 713.
2. A listed ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.
3. A listed ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

**717.6.2.1 Ceiling radiation dampers.** Ceiling radiation dampers shall be tested in accordance with Section 717.3.1. Ceiling radiation dampers shall be installed in accordance with the details listed in the fire-resistance-rated assembly and the manufacturer's installation instructions and the listing. Ceiling radiation dampers are not required where either of the following applies:

1. Tests in accordance with ASTM E 119 or UL 263 have shown that ceiling radiation dampers are not necessary in order to maintain the fire-resistance rating of the assembly.
2. Where exhaust duct penetrations are protected in accordance with Section 714.4.1.2, are located within the cavity of a wall and do not pass through another dwelling unit or tenant space.

**717.6.3 Nonfire-resistance-rated floor assemblies.** Duct systems constructed of approved materials in accordance with the *California Mechanical Code* that penetrate non-fire-resistance-rated floor assemblies shall be protected by any of the following methods:

1. A shaft enclosure in accordance with Section 713.
2. The duct connects not more than two stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion.
3. The duct connects not more than three stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the prod-

ucts of combustion and a fire damper is installed at each floor line.

**Exception:** Fire dampers are not required in ducts within individual residential dwelling units.

**717.7 Flexible ducts and air connectors.** Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

## SECTION 718 CONCEALED SPACES

**718.1 General.** Fireblocking and draftstopping shall be installed in combustible concealed locations in accordance with this section. Fireblocking shall comply with Section 718.2. Draftstopping in floor/ceiling spaces and attic spaces shall comply with Sections 718.3 and 718.4, respectively. The permitted use of combustible materials in concealed spaces of buildings of Type I or II construction shall be limited to the applications indicated in Section 718.5.

**718.2 Fireblocking.** In combustible construction, fireblocking shall be installed to cut off concealed draft openings (both vertical and horizontal) and shall form an effective barrier between floors, between a top story and a roof or attic space. Fireblocking shall be installed in the locations specified in Sections 718.2.2 through 718.2.7.

**718.2.1 Fireblocking materials.** Fireblocking shall consist of the following materials:

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints.
3. One thickness of 0.719-inch (18.3 mm) wood structural panels with joints backed by 0.719-inch (18.3 mm) wood structural panels.
4. One thickness of 0.75-inch (19.1 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-fourth-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool, mineral fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested for the specific application.

**718.2.1.1 Batts or blankets of mineral wool or mineral fiber.** Batts or blankets of mineral wool or mineral fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs.

**718.2.1.2 Unfaced fiberglass.** Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a minimum height of 16

inches (406 mm) measured vertically. When piping, conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

**718.2.1.3 Loose-fill insulation material.** Loose-fill insulation material, insulating foam sealants and caulk materials shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

**718.2.1.4 Fireblocking integrity.** The integrity of fireblocks shall be maintained.

**718.2.1.5 Double stud walls.** Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs.

**718.2.2 Concealed wall spaces.** Fireblocking shall be provided in concealed spaces of stud walls and partitions, including furred spaces, and parallel rows of studs or staggered studs, as follows:

1. Vertically at the ceiling and floor levels.
2. Horizontally at intervals not exceeding 10 feet (3048 mm).

**718.2.3 Connections between horizontal and vertical spaces.** Fireblocking shall be provided at interconnections between concealed vertical stud wall or partition spaces and concealed horizontal spaces created by an assembly of floor joists or trusses, and between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.

**718.2.4 Stairways.** Fireblocking shall be provided in concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall also comply with Section 1009.9.3.

**718.2.5 Ceiling and floor openings.** Where required by Section 712.1.7, Exception 1 of Section 714.4.1.2 or Section 714.4.2, fireblocking of the annular space around vents, pipes, ducts, chimneys and fireplaces at ceilings and floor levels shall be installed with a material specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and resist the free passage of flame and the products of combustion.

**718.2.5.1 Factory-built chimneys and fireplaces.** Factory-built chimneys and fireplaces shall be fireblocked in accordance with UL 103 and UL 127.

**718.2.6 Exterior wall coverings.** Fireblocking shall be installed within concealed spaces of exterior wall coverings and other exterior architectural elements where permitted to be of combustible construction as specified in Section 1406 or where erected with combustible frames. Fireblocking shall be installed at maximum intervals of 20 feet (6096 mm) in either dimension so that there will be no concealed space exceeding 100 square feet (9.3 m<sup>2</sup>) between fireblocking. Where wood furring strips are used, they shall be of approved wood of natural decay resistance

or preservative-treated wood. If noncontinuous, such elements shall have closed ends, with at least 4 inches (102 mm) of separation between sections.

**Exceptions:**

1. Fireblocking of cornices is not required in single-family dwellings. Fireblocking of cornices of a two-family dwelling is required only at the line of dwelling unit separation.
2. Fireblocking shall not be required where the exterior wall covering is installed on noncombustible framing and the face of the exterior wall covering exposed to the concealed space is covered by one of the following materials:
  - 2.1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm).
  - 2.2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point.
  - 2.3. Other approved noncombustible materials.
3. Fireblocking shall not be required where the exterior wall covering has been tested in accordance with, and complies with the acceptance criteria of, NFPA 285. The exterior wall covering shall be installed as tested in accordance with NFPA 285.

**718.2.7 Concealed sleeper spaces.** Where wood sleepers are used for laying wood flooring on masonry or concrete fire-resistance-rated floors, the space between the floor slab and the underside of the wood flooring shall be filled with an approved material to resist the free passage of flame and products of combustion or fireblocked in such a manner that there will be no open spaces under the flooring that will exceed 100 square feet (9.3 m<sup>2</sup>) in area and such space shall be filled solidly under permanent partitions so that there is no communication under the flooring between adjoining rooms.

**Exceptions:**

1. Fireblocking is not required for slab-on-grade floors in gymnasiums.
2. Fireblocking is required only at the juncture of each alternate lane and at the ends of each lane in a bowling facility.

**718.3 Draftstopping in floors.** In combustible construction, draftstopping shall be installed to subdivide floor/ceiling assemblies in the locations prescribed in Sections 718.3.2 through 718.3.3.

**718.3.1 Draftstopping materials.** Draftstopping materials shall not be less than 1/2-inch (12.7 mm) gypsum board, 3/8-inch (9.5 mm) wood structural panel, 3/8-inch (9.5 mm) particleboard, 1-inch (25-mm) nominal lumber, cement fiberboard, batts or blankets of mineral wool or glass fiber, or other approved materials adequately supported. The integrity of draftstops shall be maintained.

**718.3.2 Groups R-1, R-2, R-3 and R-4.** Draftstopping shall be provided in floor/ceiling spaces in Group R-1

buildings, in Group R-2 buildings with three or more dwelling units, in Group R-3 buildings with two dwelling units and in Group R-4 buildings. Draftstopping shall be located above and in line with the dwelling unit and sleeping unit separations.

**Exceptions:**

1. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.2, provided that automatic sprinklers are also installed in the combustible concealed spaces where the draftstopping is being omitted.

**718.3.3 Other groups.** In other groups, draftstopping shall be installed so that horizontal floor areas do not exceed 1,000 square feet (93 m<sup>2</sup>).

**Exceptions:**

1. *In other than Group A, E, H, I, L and R-2.1 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.*
2. *In Group A, E, H, I and L occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, where an automatic sprinkler system in accordance with Section 903.3.1.1 is installed, the area between draft stops may be 3,000 square feet (279 m<sup>2</sup>) and the greatest horizontal dimension may be 100 feet (30 480 mm).*

**718.4 Draftstopping in attics.** In combustible construction, draftstopping shall be installed to subdivide attic spaces and concealed roof spaces in the locations prescribed in Sections 718.4.2 and 718.4.3. Ventilation of concealed roof spaces shall be maintained in accordance with Section 1203.2.

**718.4.1 Draftstopping materials.** Materials utilized for draftstopping of attic spaces shall comply with Section 718.3.1.

**718.4.1.1 Openings.** Openings in the partitions shall be protected by self-closing doors with automatic latches constructed as required for the partitions.

**718.4.2 Groups R-1 and R-2.** Draftstopping shall be provided in attics, mansards, overhangs or other concealed roof spaces of Group R-2 buildings with three or more dwelling units and in all Group R-1 buildings. Draftstopping shall be installed above, and in line with, sleeping unit and dwelling unit separation walls that do not extend to the underside of the roof sheathing above.

**Exceptions:**

1. Where corridor walls provide a sleeping unit or dwelling unit separation, draftstopping shall only be required above one of the corridor walls.

2. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. In occupancies in Group R-2 that do not exceed four stories above grade plane, the attic space shall be subdivided by draftstops into areas not exceeding 3,000 square feet (279 m<sup>2</sup>) or above every two dwelling units, whichever is smaller.
4. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.2, provided that automatic sprinklers are also installed in the combustible concealed space where the draftstopping is being omitted.

**718.4.3 Other groups.** Draftstopping shall be installed in attics and concealed roof spaces, such that any horizontal area does not exceed 3,000 square feet (279 m<sup>2</sup>).

**Exceptions:**

1. *In other than Group A, E, H, I and L and R-2.1 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.*
2. *In Group A, E, H, I L and R-2.1 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, where an automatic sprinkler system in accordance with Section 903.3.1.1 is installed, the area between draft stops may be 9,000 square feet (836 m<sup>2</sup>) and the greatest horizontal dimension may be 100 feet (30 480 mm).*

**718.5 Combustible materials in concealed spaces in Type I or II construction.** Combustible materials shall not be permitted in concealed spaces of buildings of Type I or II construction.

**Exceptions:**

1. Combustible materials in accordance with Section 603.
2. Combustible materials exposed within plenums complying with Section 602 of the *California Mechanical Code*.
3. Class A interior finish materials classified in accordance with Section 803.
4. Combustible piping within partitions or shaft enclosures installed in accordance with the provisions of this code.
5. Combustible piping within concealed ceiling spaces installed in accordance with the *California Mechanical Code* and the *California Plumbing Code*.
6. Combustible insulation and covering on pipe and tubing, installed in concealed spaces other than plenums, complying with Section 720.7.

## SECTION 719 FIRE-RESISTANCE REQUIREMENTS FOR PLASTER

**719.1 Thickness of plaster.** The minimum thickness of gypsum plaster or Portland cement plaster used in a fire-resistance-rated system shall be determined by the prescribed fire tests. The plaster thickness shall be measured from the face of the lath where applied to gypsum lath or metal lath.

**719.2 Plaster equivalents.** For fire-resistance purposes,  $\frac{1}{2}$  inch (12.7 mm) of unsanded gypsum plaster shall be deemed equivalent to  $\frac{3}{4}$  inch (19.1 mm) of one-to-three gypsum sand plaster or 1 inch (25 mm) of Portland cement sand plaster.

**719.3 Noncombustible furring.** In buildings of Type I and II construction, plaster shall be applied directly on concrete or masonry or on approved noncombustible plastering base and furring.

**719.4 Double reinforcement.** Plaster protection more than 1 inch (25 mm) in thickness shall be reinforced with an additional layer of approved lath embedded at least  $\frac{3}{4}$  inch (19.1 mm) from the outer surface and fixed securely in place.

**Exception:** Solid plaster partitions or where otherwise determined by fire tests.

**719.5 Plaster alternatives for concrete.** In reinforced concrete construction, gypsum plaster or Portland cement plaster is permitted to be substituted for  $\frac{1}{2}$  inch (12.7 mm) of the required poured concrete protection, except that a minimum thickness of  $\frac{3}{8}$  inch (9.5 mm) of poured concrete shall be provided in reinforced concrete floors and 1 inch (25 mm) in reinforced concrete columns in addition to the plaster finish. The concrete base shall be prepared in accordance with Section 2510.7.

## SECTION 720 THERMAL- AND SOUND-INSULATING MATERIALS

**720.1 General.** Insulating materials, including facings such as vapor retarders and vapor-permeable membranes, similar coverings and all layers of single and multilayer reflective foil insulations, shall comply with the requirements of this section. Where a flame spread index or a smoke-developed index is specified in this section, such index shall be determined in accordance with ASTM E 84 or UL 723. Any material that is subject to an increase in flame spread index or smoke-developed index beyond the limits herein established through the effects of age, moisture or other atmospheric conditions shall not be permitted.

**Exceptions:**

1. Fiberboard insulation shall comply with Chapter 23.
2. Foam plastic insulation shall comply with Chapter 26.
3. Duct and pipe insulation and duct and pipe coverings and linings in plenums shall comply with the *California Mechanical Code*.
4. All layers of single and multilayer reflective plastic core insulation shall comply with Section 2613.

**720.2 Concealed installation.** Insulating materials, where concealed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

**Exception:** Cellulose loose-fill insulation that is not spray applied, complying with the requirements of Section 720.6, shall only be required to meet the smoke-developed index of not more than 450.

**720.2.1 Facings.** Where such materials are installed in concealed spaces in buildings of Type III, IV or V construction, the flame spread and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil insulation that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish.

**Exception:** All layers of single and multilayer reflective plastic core insulation shall comply with Section 2613.

**720.3 Exposed installation.** Insulating materials, where exposed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

**Exception:** Cellulose loose-fill insulation that is not spray applied complying with the requirements of Section 720.6 shall only be required to meet the smoke-developed index of not more than 450.

**720.3.1 Attic floors.** Exposed insulation materials installed on attic floors shall have a critical radiant flux of not less than 0.12 watt per square centimeter when tested in accordance with ASTM E 970.

**720.4 Loose-fill insulation.** Loose-fill insulation materials that cannot be mounted in the ASTM E 84 or UL 723 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Sections 720.2 and 720.3 when tested in accordance with CAN/ULC S102.2.

**Exception:** Cellulose loose-fill insulation shall not be required to be tested in accordance with CAN/ULC S102.2, provided such insulation complies with the requirements of Section 720.2 or 720.3, as applicable, and Section 720.6.

**720.5 Roof insulation.** The use of combustible roof insulation not complying with Sections 720.2 and 720.3 shall be permitted in any type of construction provided it is covered with approved roof coverings directly applied thereto.

**720.6 Cellulose loose-fill insulation.** Cellulose loose-fill insulation shall comply with CPSC 16 CFR Part 1209 and

CPSC 16 CFR Part 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR Part 1209 and CPSC 16 CFR Part 1404.

**720.7 Insulation and covering on pipe and tubing.** Insulation and covering on pipe and tubing shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

**Exception:** Insulation and covering on pipe and tubing installed in plenums shall comply with the *California Mechanical Code*.

## SECTION 721 PRESCRIPTIVE FIRE RESISTANCE

**721.1 General.** The provisions of this section contain prescriptive details of fire-resistance-rated building elements, components or assemblies. The materials of construction listed in Tables 721.1(1), 721.1(2), and 721.1(3) shall be assumed to have the fire-resistance ratings prescribed therein. Where materials that change the capacity for heat dissipation are incorporated into a fire-resistance-rated assembly, fire test results or other substantiating data shall be made available to the building official to show that the required fire-resistance-rating time period is not reduced.

**721.1.1 Thickness of protective coverings.** The thickness of fire-resistant materials required for protection of structural members shall be not less than set forth in Table 721.1(1), except as modified in this section. The figures shown shall be the net thickness of the protecting materials and shall not include any hollow space in back of the protection.

**721.1.2 Unit masonry protection.** Where required, metal ties shall be embedded in bed joints of unit masonry for protection of steel columns. Such ties shall be as set forth in Table 721.1(1) or be equivalent thereto.

**721.1.3 Reinforcement for cast-in-place concrete column protection.** Cast-in-place concrete protection for steel columns shall be reinforced at the edges of such members with wire ties of not less than 0.18 inch (4.6 mm) in diameter wound spirally around the columns on a pitch of not more than 8 inches (203 mm) or by equivalent reinforcement.

**721.1.4 Plaster application.** The finish coat is not required for plaster protective coatings where they comply with the design mix and thickness requirements of Tables 721.1(1), 721.1(2) and 721.1(3).

**TABLE 721.1(1)**  
**MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS**  
**FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS<sup>m</sup>**

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Steel columns and all of primary trusses (continued)	1-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 6" × 6" or greater (not including sandstone, granite and siliceous gravel). <sup>a</sup>	2½	2	1½	1
	1-1.2	Carbonate, lightweight and sand-lightweight aggregate concrete, members 8" × 8" or greater (not including sandstone, granite and siliceous gravel). <sup>a</sup>	2	1½	1	1
	1-1.3	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" × 12" or greater (not including sandstone, granite and siliceous gravel). <sup>a</sup>	1½	1	1	1
	1-1.4	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 6" × 6" or greater. <sup>a</sup>	3	2	1½	1
	1-1.5	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 8" × 8" or greater. <sup>a</sup>	2½	2	1	1
	1-1.6	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 12" × 12" or greater. <sup>a</sup>	2	1	1	1
	1-2.1	Clay or shale brick with brick and mortar fill. <sup>a</sup>	3¾	—	—	2¼
	1-3.1	4" hollow clay tile in two 2" layers; ½" mortar between tile and column; ⅜" metal mesh 0.046" wire diameter in horizontal joints; tile fill. <sup>a</sup>	4	—	—	—
	1-3.2	2" hollow clay tile; ¾" mortar between tile and column; ⅜" metal mesh 0.046" wire diameter in horizontal joints; limestone concrete fill <sup>a</sup> ; plastered with ¾" gypsum plaster.	3	—	—	—
	1-3.3	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile or ⅜" metal mesh 0.046" diameter wire in horizontal joints; limestone or trap-rock concrete fill <sup>a</sup> extending 1" outside column on all sides.	—	—	3	—
	1-3.4	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile with or without concrete fill; ¾" mortar between tile and column.	—	—	—	2
	1-4.1	Cement plaster over metal lath wire tied to ¾" cold-rolled vertical channels with 0.049" (No. 18 B.W. gage) wire ties spaced 3" to 6" on center. Plaster mixed 1:2 ½ by volume, cement to sand.	—	—	2½ <sup>b</sup>	7/8
	1-5.1	Vermiculite concrete, 1:4 mix by volume over paperbacked wire fabric lath wrapped directly around column with additional 2" × 2" 0.065" /0.065" (No. 16/16 B.W. gage) wire fabric placed ¾" from outer concrete surface. Wire fabric tied with 0.049" (No. 18 B.W. gage) wire spaced 6" on center for inner layer and 2" on center for outer layer.	2	—	—	—
	1-6.1	Perlite or vermiculite gypsum plaster over metal lath wrapped around column and furred 1¼" from column flanges. Sheets lapped at ends and tied at 6" intervals with 0.049" (No. 18 B.W. gage) tie wire. Plaster pushed through to flanges.	1½	1	—	—
	1-6.2	Perlite or vermiculite gypsum plaster over self-furring metal lath wrapped directly around column, lapped 1" and tied at 6" intervals with 0.049" (No. 18 B.W. gage) wire.	1¾	1⅜	1	—
	1-6.3	Perlite or vermiculite gypsum plaster on metal lath applied to ¾" cold-rolled channels spaced 24" apart vertically and wrapped flatwise around column.	1½	—	—	—
	1-6.4	Perlite or vermiculite gypsum plaster over two layers of ½" plain full-length gypsum lath applied tight to column flanges. Lath wrapped with 1" hexagonal mesh of No. 20 gage wire and tied with doubled 0.035" diameter (No. 18 B.W. gage) wire ties spaced 23" on center. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2½ cubic feet of aggregate for the 3-hour system.	2½	2	—	—

(continued)

**TABLE 721.1(1)—continued**  
**MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS**  
**FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS<sup>m</sup>**

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Steel columns and all of primary trusses	1-6.5	Perlite or vermiculite gypsum plaster over one layer of 1/2" plain full-length gypsum lath applied tight to column flanges. Lath tied with doubled 0.049" (No. 18 B.W. gage) wire ties spaced 23" on center and scratch coat wrapped with 1" hexagonal mesh 0.035" (No. 20 B.W. gage) wire fabric. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate.	—	2	—	—
	1-7.1	Multiple layers of 1/2" gypsum wallboard <sup>c</sup> adhesively <sup>d</sup> secured to column flanges and successive layers. Wallboard applied without horizontal joints. Corner edges of each layer staggered. Wallboard layer below outer layer secured to column with doubled 0.049" (No. 18 B.W. gage) steel wire ties spaced 15" on center. Exposed corners taped and treated.	—	—	2	1
	1-7.2	Three layers of 5/8" Type X gypsum wallboard. <sup>c</sup> First and second layer held in place by 1/8" diameter by 1 3/8" long ring shank nails with 5/16" diameter heads spaced 24" on center at corners. Middle layer also secured with metal straps at mid-height and 18" from each end, and by metal corner bead at each corner held by the metal straps. Third layer attached to corner bead with 1" long gypsum wallboard screws spaced 12" on center.	—	—	1 7/8	—
	1-7.3	Three layers of 5/8" Type X gypsum wallboard, <sup>c</sup> each layer screw attached to 1 5/8" steel studs 0.018" thick (No. 25 carbon sheet steel gage) at each corner of column. Middle layer also secured with 0.049" (No. 18 B.W. gage) double-strand steel wire ties, 24" on center. Screws are No. 6 by 1" spaced 24" on center for inner layer, No. 6 by 1 5/8" spaced 12" on center for middle layer and No. 8 by 2 1/4" spaced 12" on center for outer layer.	—	1 7/8	—	—
	1-8.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum-to-sand aggregate applied over metal lath. Lath lapped 1" and tied 6" on center at all end, edges and spacers with 0.049" (No. 18 B.W. gage) steel tie wires. Lath applied over 1/2" spacers made of 3/4" furring channel with 2" legs bent around each corner. Spacers located 1" from top and bottom of member and a maximum of 40" on center and wire tied with a single strand of 0.049" (No. 18 B.W. gage) steel tie wires. Corner bead tied to the lath at 6" on center along each corner to provide plaster thickness.	—	—	1 5/8	—
	1-9.1	Minimum W8x35 wide flange steel column (w/d ≥ 0.75) with each web cavity filled even with the flange tip with normal weight carbonate or siliceous aggregate concrete (3,000 psi minimum compressive strength with 145 pcf ± 3 pcf unit weight). Reinforce the concrete in each web cavity with a minimum No. 4 deformed reinforcing bar installed vertically and centered in the cavity, and secured to the column web with a minimum No. 2 horizontal deformed reinforcing bar welded to the web every 18" on center vertically. As an alternative to the No. 4 rebar, 3/4" diameter by 3" long headed studs, spaced at 12" on center vertically, shall be welded on each side of the web mid-way between the column flanges.	—	—	—	See Note n
2. Webs or flanges of steel beams and girders (continued)	2-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete (not including sand-stone, granite and siliceous gravel) with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2	1 1/2	1	1
	2-1.2	Siliceous aggregate concrete and concrete excluded in Item 2-1.1 with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2 1/2	2	1 1/2	1
	2-2.1	Cement plaster on metal lath attached to 3/4" cold-rolled channels with 0.04" (No. 18 B.W. gage) wire ties spaced 3" to 6" on center. Plaster mixed 1:2 1/2 by volume, cement to sand.	—	—	2 1/2 <sup>b</sup>	7/8

(continued)



**TABLE 721.1(1)—continued**  
**MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS**  
**FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS<sup>m</sup>**

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
2. Webs or flanges of steel beams and girders	2-3.1	Vermiculite gypsum plaster on a metal lath cage, wire tied to 0.165" diameter (No. 8 B.W. gage) steel wire hangers wrapped around beam and spaced 16" on center. Metal lath ties spaced approximately 5" on center at cage sides and bottom.	—	7/8	—	—
	2-4.1	Two layers of 5/8" Type X gypsum wallboard <sup>c</sup> are attached to U-shaped brackets spaced 24" on center. 0.018" thick (No. 25 carbon sheet steel gage) 1 5/8" deep by 1" galvanized steel runner channels are first installed parallel to and on each side of the top beam flange to provide a 1/2" clearance to the flange. The channel runners are attached to steel deck or concrete floor construction with approved fasteners spaced 12" on center. U-shaped brackets are formed from members identical to the channel runners. At the bent portion of the U-shaped bracket, the flanges of the channel are cut out so that 1 5/8" deep corner channels can be inserted without attachment parallel to each side of the lower flange.  As an alternative, 0.021" thick (No. 24 carbon sheet steel gage) 1" × 2" runner and corner angles may be used in lieu of channels, and the web cutouts in the U-shaped brackets may be omitted. Each angle is attached to the bracket with 1/2"-long No. 8 self-drilling screws. The vertical legs of the U-shaped bracket are attached to the runners with one 1/2" long No. 8 self-drilling screw. The completed steel framing provides a 2 1/8" and 1 1/2" space between the inner layer of wallboard and the sides and bottom of the steel beam, respectively. The inner layer of wallboard is attached to the top runners and bottom corner channels or corner angles with 1 1/4"-long No. 6 self-drilling screws spaced 16" on center. The outer layer of wallboard is applied with 1 3/4"-long No. 6 self-drilling screws spaced 8" on center. The bottom corners are reinforced with metal corner beads.	—	—	1 1/4	—
	2-4.2	Three layers of 5/8" Type X gypsum wallboard <sup>c</sup> attached to a steel suspension system as described immediately above utilizing the 0.018" thick (No. 25 carbon sheet steel gage) 1" × 2" lower corner angles. The framing is located so that a 2 1/8" and 2" space is provided between the inner layer of wallboard and the sides and bottom of the beam, respectively. The first two layers of wallboard are attached as described immediately above. A layer of 0.035" thick (No. 20 B.W. gage) 1" hexagonal galvanized wire mesh is applied under the soffit of the middle layer and up the sides approximately 2". The mesh is held in position with the No. 6 1 5/8"-long screws installed in the vertical leg of the bottom corner angles. The outer layer of wallboard is attached with No. 6 2 1/4"-long screws spaced 8" on center. One screw is also installed at the mid-depth of the bracket in each layer. Bottom corners are finished as described above.	—	1 7/8	—	—
3. Bonded pre-tensioned reinforcement in prestressed concrete <sup>c</sup>	3-1.1	Carbonate, lightweight, sand-lightweight and siliceous <sup>f</sup> aggregate concrete Beams or girders	4 <sup>g</sup>	3 <sup>g</sup>	2 1/2	1 1/2
		Solid <sup>h</sup>		2	1 1/2	1

(continued)

# FIRE AND SMOKE PROTECTION FEATURES

**TABLE 721.1(1) —continued**  
**MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS**  
**FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS<sup>m</sup>**

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
4. Bonded or unbonded post-tensioned in pre-stressed concrete <sup>e, i</sup>	4-1.1	Carbonate, lightweight, sand-lightweight and siliceous <sup>f</sup> aggregate concrete				
		Unrestrained members: Solid slabs <sup>h</sup> Beams and girders <sup>j</sup> 8" wide greater than 12" wide	— 3	2 4 1/2 2 1/2	1 1/2 2 1/2 2	— 1 3/4 1 1/2
	4-1.2	Carbonate, lightweight, sand-lightweight and siliceous aggregate				
		Restrained members: <sup>k</sup> Solid slabs <sup>h</sup> Beams and girders <sup>j</sup> 8" wide greater than 12" wide	1 1/4 2 1/2 2	1 2 1 3/4	3/4 1 3/4 1 1/2	— — —
5. Reinforcing steel in reinforced concrete columns, beams girders and trusses	5-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	1 1/2	1 1/2	1 1/2	1 1/2
		Siliceous aggregate concrete, members 12" or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	2	1 1/2	1 1/2	1 1/2
6. Reinforcing steel in reinforced concrete joists <sup>l</sup>	6-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete	1 1/4	1 1/4	1	3/4
	6-1.2	Siliceous aggregate concrete	1 3/4	1 1/2	1	3/4
7. Reinforcing and tie rods in floor and roof slabs <sup>l</sup>	7-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete	1	1	3/4	3/4
	7-1.2	Siliceous aggregate concrete	1 1/4	1	1	3/4

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm<sup>2</sup>, 1 cubic foot = 0.0283 m<sup>3</sup>, 1 pound per cubic foot = 16.02 kg/m<sup>3</sup>.

- Reentrant parts of protected members to be filled solidly.
- Two layers of equal thickness with a 3/4-inch airspace between.
- For all of the construction with gypsum wallboard described in Table 721.1(1), gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard and the joints on the face layer are reinforced, and the entire surface is covered with a minimum of 1/16-inch gypsum veneer plaster.
- An approved adhesive qualified under ASTM E 119 or UL 263.
- Where lightweight or sand-lightweight concrete having an oven-dry weight of 110 pounds per cubic foot or less is used, the tabulated minimum cover shall be permitted to be reduced 25 percent, except that in no case shall the cover be less than 3/4 inch in slabs or 1 1/2 inches in beams or girders.
- For solid slabs of siliceous aggregate concrete, increase tendon cover 20 percent.
- Adequate provisions against spalling shall be provided by U-shaped or hooped stirrups spaced not to exceed the depth of the member with a clear cover of 1 inch.
- Prestressed slabs shall have a thickness not less than that required in Table 721.1(3) for the respective fire-resistance time period.
- Fire coverage and end anchorages shall be as follows: Cover to the prestressing steel at the anchor shall be 1/2 inch greater than that required away from the anchor. Minimum cover to steel-bearing plate shall be 1 inch in beams and 3/4 inch in slabs.
- For beam widths between 8 inches and 12 inches, cover thickness shall be permitted to be determined by interpolation.
- Interior spans of continuous slabs, beams and girders shall be permitted to be considered restrained.
- For use with concrete slabs having a comparable fire endurance where members are framed into the structure in such a manner as to provide equivalent performance to that of monolithic concrete construction.
- Generic fire-resistance ratings (those not designated as PROPRIETARY\* in the listing) in GA 600 shall be accepted as if herein listed.
- No additional insulating material is required on the exposed outside face of the column flange to achieve a 1-hour fire-resistance rating.

**TABLE 721.1(2)**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>p</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Brick of clay or shale	1-1.1	Solid brick of clay or shale <sup>c</sup> .	6	4.9	3.8	2.7
	1-1.2	Hollow brick, not filled.	5.0	4.3	3.4	2.3
	1-1.3	Hollow brick unit wall, grout or filled with perlite vermiculite or expanded shale aggregate.	6.6	5.5	4.4	3.0
	1-2.1	4" nominal thick units at least 75 percent solid backed with a hat-shaped metal furring channel $\frac{3}{4}$ " thick formed from 0.021" sheet metal attached to the brick wall on 24" centers with approved fasteners, and $\frac{1}{2}$ " Type X gypsum wallboard attached to the metal furring strips with 1"-long Type S screws spaced 8" on center.	—	—	5 <sup>d</sup>	—
2. Combination of clay brick and load-bearing hollow clay tile	2-1.1	4" solid brick and 4" tile (at least 40 percent solid).	—	8	—	—
	2-1.2	4" solid brick and 8" tile (at least 40 percent solid).	12	—	—	—
3. Concrete masonry units	3-1.1 <sup>f, g</sup>	Expanded slag or pumice.	4.7	4.0	3.2	2.1
	3-1.2 <sup>f, g</sup>	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
	3-1.3 <sup>f</sup>	Limestone, cinders or air-cooled slag.	5.9	5.0	4.0	2.7
	3-1.4 <sup>f, g</sup>	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8
4. Solid concrete <sup>h, i</sup>	4-1.1	Siliceous aggregate concrete.	7.0	6.2	5.0	3.5
		Carbonate aggregate concrete.	6.6	5.7	4.6	3.2
		Sand-lightweight concrete.	5.4	4.6	3.8	2.7
		Lightweight concrete.	5.1	4.4	3.6	2.5
5. Glazed or unglazed facing tile, nonload-bearing	5-1.1	One 2" unit cored 15 percent maximum and one 4" unit cored 25 percent maximum with $\frac{3}{4}$ " mortar-filled collar joint. Unit positions reversed in alternate courses.	—	6 $\frac{3}{8}$	—	—
	5-1.2	One 2" unit cored 15 percent maximum and one 4" unit cored 40 percent maximum with $\frac{3}{4}$ " mortar-filled collar joint. Unit positions side with $\frac{3}{4}$ " gypsum plaster. Two wythes tied together every fourth course with No. 22 gage corrugated metal ties.	—	6 $\frac{3}{4}$	—	—
	5-1.3	One unit with three cells in wall thickness, cored 29 percent maximum.	—	—	6	—
	5-1.4	One 2" unit cored 22 percent maximum and one 4" unit cored 41 percent maximum with $\frac{1}{4}$ " mortar-filled collar joint. Two wythes tied together every third course with 0.030" (No. 22 galvanized sheet steel gage) corrugated metal ties.	—	—	6	—
	5-1.5	One 4" unit cored 25 percent maximum with $\frac{3}{4}$ " gypsum plaster on one side.	—	—	4 $\frac{3}{4}$	—
	5-1.6	One 4" unit with two cells in wall thickness, cored 22 percent maximum.	—	—	—	4
	5-1.7	One 4" unit cored 30 percent maximum with $\frac{3}{4}$ " vermiculite gypsum plaster on one side.	—	—	4 $\frac{1}{2}$	—
	5-1.8	One 4" unit cored 39 percent maximum with $\frac{3}{4}$ " gypsum plaster on one side.	—	—	—	4 $\frac{1}{2}$

(continued)

**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
6. Solid gypsum plaster	6-1.1	$\frac{3}{4}$ " by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with 2.6-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. Gage) wire at 6" spacing. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2 <sup>d</sup>
	6-1.2	$\frac{3}{4}$ " by 0.05" (No. 16 carbon sheet steel gage) cold-rolled channels 16" on center with metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Perlite or vermiculite gypsum plaster each side. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 $\frac{1}{2}$ cubic feet of aggregate for the 1-hour system.	—	—	2 $\frac{1}{2}$ <sup>d</sup>	2 <sup>d</sup>
	6-1.3	$\frac{3}{4}$ " by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with $\frac{3}{8}$ " gypsum lath applied to one face and attached with sheet metal clips. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2 <sup>d</sup>
	6-2.1	Studless with $\frac{1}{2}$ " full-length plain gypsum lath and gypsum plaster each side. Plaster mixed 1:1 for scratch coat and 1:2 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	2 <sup>d</sup>
	6-2.2	Studless with $\frac{1}{2}$ " full-length plain gypsum lath and perlite or vermiculite gypsum plaster each side.	—	—	2 $\frac{1}{2}$ <sup>d</sup>	2 <sup>d</sup>
	6-2.3	Studless partition with $\frac{3}{8}$ " rib metal lath installed vertically adjacent edges tied 6" on center with No. 18 gage wire ties, gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2 <sup>d</sup>
7. Solid perlite and Portland cement	7-1.1	Perlite mixed in the ratio of 3 cubic feet to 100 pounds of Portland cement and machine applied to stud side of 1 $\frac{1}{2}$ " mesh by 0.058-inch (No. 17 B.W. gage) paper-backed woven wire fabric lath wire-tied to 4"-deep steel trussed wire studs 16" on center. Wire ties of 0.049" (No. 18 B.W. gage) galvanized steel wire 6" on center vertically.	—	—	3 $\frac{1}{8}$ <sup>d</sup>	—
8. Solid neat wood fibered gypsum plaster	8-1.1	$\frac{3}{4}$ " by 0.055-inch (No. 16 carbon sheet steel gage) cold-rolled channels, 12" on center with 2.5-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Neat gypsum plaster applied each side.	—	—	2 <sup>d</sup>	—
9. Solid wall-board partition	9-1.1	One full-length layer $\frac{1}{2}$ " Type X gypsum wallboard <sup>c</sup> laminated to each side of 1" full-length V-edge gypsum coreboard with approved laminating compound. Vertical joints of face layer and coreboard staggered at least 3".	—	—	2 <sup>d</sup>	—
10. Hollow (studless) gypsum wallboard partition	10-1.1	One full-length layer of $\frac{5}{8}$ " Type X gypsum wallboard <sup>c</sup> attached to both sides of wood or metal top and bottom runners laminated to each side of 1"×6" full-length gypsum coreboard ribs spaced 2" on center with approved laminating compound. Ribs centered at vertical joints of face plies and joints staggered 24" in opposing faces. Ribs may be recessed 6" from the top and bottom.	—	—	—	2 $\frac{1}{4}$ <sup>d</sup>
	10-1.2	1" regular gypsum V-edge full-length backing board attached to both sides of wood or metal top and bottom runners with nails or 1 $\frac{5}{8}$ " drywall screws at 24" on center. Minimum width of runners 1 $\frac{5}{8}$ ". Face layer of $\frac{1}{2}$ " regular full-length gypsum wallboard laminated to outer faces of backing board with approved laminating compound.	—	—	4 $\frac{5}{8}$ <sup>d</sup>	—

(continued)

**TABLE 721.1(2) —continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
11. Noncombustible studs-interior partition with plaster each side	11-1.1	3 1/4" × 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 24" on center. 5/8" gypsum plaster on metal lath each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	4 3/4 <sup>d</sup>
	11-1.2	3 3/8" × 0.055" (No. 16 carbon sheet steel gage) approved nailable <sup>k</sup> studs spaced 24" on center. 5/8" neat gypsum wood-fibered plaster each side over 3/8" rib metal lath nailed to studs with 6d common nails, 8" on center. Nails driven 1 1/4" and bent over.	—	—	5 5/8	—
	11-1.3	4" × 0.044" (No. 18 carbon sheet steel gage) channel-shaped steel studs at 16" on center. On each side approved resilient clips pressed onto stud flange at 16" vertical spacing, 1/4" pencil rods snapped into or wire tied onto outer loop of clips, metal lath wire-tied to pencil rods at 6" intervals, 1" perlite gypsum plaster, each side.	—	7 5/8 <sup>d</sup>	—	—
	11-1.4	2 1/2" × 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 16" on center. Wood fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied on 3/4" pound metal lath wire tied to studs, each side. 3/4" plaster applied over each face, including finish coat.	—	—	4 1/4 <sup>d</sup>	—
12. Wood studs interior partition with plaster each side	12-1.1 <sup>l, m</sup>	2" × 4" wood studs 16" on center with 5/8" gypsum plaster on metal lath. Lath attached by 4d common nails bent over or No. 14 gage by 1 1/4" by 3/4" crown width staples spaced 6" on center. Plaster mixed 1:1 1/2 for scratch coat and 1:3 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	5 1/8
	12-1.2 <sup>l</sup>	2" × 4" wood studs 16" on center with metal lath and 7/8" neat wood-fibered gypsum plaster each side. Lath attached by 6d common nails, 7" on center. Nails driven 1 1/4" and bent over.	—	—	5 1/2 <sup>d</sup>	—
	12-1.3 <sup>l</sup>	2" × 4" wood studs 16" on center with 3/8" perforated or plain gypsum lath and 1/2" gypsum plaster each side. Lath nailed with 1 1/8" by No. 13 gage by 19/64" head plasterboard blued nails, 4" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	5 1/4
	12-1.4 <sup>l</sup>	2" × 4" wood studs 16" on center with 3/8" Type X gypsum lath and 1/2" gypsum plaster each side. Lath nailed with 1 1/8" by No. 13 gage by 19/64" head plasterboard blued nails, 5" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	5 1/4
13. Noncombustible studs-interior partition with gypsum wallboard each side	13-1.1	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 24" on center with one full-length layer of 5/8" Type X gypsum wallboard <sup>e</sup> applied vertically attached with 1" long No. 6 drywall screws to each stud. Screws are 8" on center around the perimeter and 12" on center on the intermediate stud. The wallboard may be applied horizontally when attached to 3 5/8" studs and the horizontal joints are staggered with those on the opposite side. Screws for the horizontal application shall be 8" on center at vertical edges and 12" on center at intermediate studs.	—	—	—	2 7/8 <sup>d</sup>
	13-1.2	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 25" on center with two full-length layers of 1/2" Type X gypsum wallboard <sup>e</sup> applied vertically each side. First layer attached with 1"-long, No. 6 drywall screws, 8" on center around the perimeter and 12" on center on the intermediate stud. Second layer applied with vertical joints offset one stud space from first layer using 1 5/8" long, No. 6 drywall screws spaced 9" on center along vertical joints, 12" on center at intermediate studs and 24" on center along top and bottom runners.	—	—	3 5/8 <sup>d</sup>	—
	13-1.3	0.055" (No. 16 carbon sheet steel gage) approved nailable metal studs <sup>e</sup> 24" on center with full-length 5/8" Type X gypsum wallboard <sup>e</sup> applied vertically and nailed 7" on center with 6d cement-coated common nails. Approved metal fastener grips used with nails at vertical butt joints along studs.	—	—	—	4 7/8

(continued)

**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
14. Wood studs-interior partition with gypsum wallboard each side	14-1.1 <sup>h, m</sup>	2" × 4" wood studs 16" on center with two layers of $\frac{3}{8}$ " regular gypsum wallboard <sup>e</sup> each side, 4d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 8" on center first layer, 5d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 8" on center second layer with laminating compound between layers, joints staggered. First layer applied full length vertically, second layer applied horizontally or vertically.	—	—	—	5
	14-1.2 <sup>h, m</sup>	2" × 4" wood studs 16" on center with two layers $\frac{1}{2}$ " regular gypsum wallboard <sup>e</sup> applied vertically or horizontally each side <sup>k</sup> , joints staggered. Nail base layer with 5d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 8" on center face layer with 8d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 8" on center.	—	—	—	5 $\frac{1}{2}$
	14-1.3 <sup>h, m</sup>	2" × 4" wood studs 24" on center with $\frac{5}{8}$ " Type X gypsum wallboard <sup>e</sup> applied vertically or horizontally nailed with 6d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 7" on center with end joints on nailing members. Stagger joints each side.	—	—	—	4 $\frac{3}{4}$
	14-1.4 <sup>l</sup>	2" × 4" fire-retardant-treated wood studs spaced 24" on center with one layer of $\frac{5}{8}$ " Type X gypsum wallboard <sup>e</sup> applied with face paper grain (long dimension) parallel to studs. Wallboard attached with 6d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 7" on center.	—	—	—	4 $\frac{3}{4}$ <sup>d</sup>
	14-1.5 <sup>h, m</sup>	2" × 4" wood studs 16" on center with two layers $\frac{5}{8}$ " Type X gypsum wallboard <sup>e</sup> each side. Base layers applied vertically and nailed with 6d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 9" on center. Face layer applied vertically or horizontally and nailed with 8d cooler <sup>n</sup> or wallboard <sup>n</sup> nails at 7" on center. For nail-adhesive application, base layers are nailed 6" on center. Face layers applied with coating of approved wallboard adhesive and nailed 12" on center.	—	—	6	—
	14-1.6 <sup>l</sup>	2" × 3" fire-retardant-treated wood studs spaced 24" on center with one layer of $\frac{5}{8}$ " Type X gypsum wallboard <sup>e</sup> applied with face paper grain (long dimension) at right angles to studs. Wallboard attached with 6d cement-coated box nails spaced 7" on center.	—	—	—	3 $\frac{5}{8}$ <sup>d</sup>
15. Exterior or interior walls (continued)	15-1.1 <sup>h, m</sup>	Exterior surface with $\frac{3}{4}$ " drop siding over $\frac{1}{2}$ " gypsum sheathing on 2" × 4" wood studs at 16" on center, interior surface treatment as required for 1-hour-rated exterior or interior 2" × 4" wood stud partitions. Gypsum sheathing nailed with 1 $\frac{3}{4}$ " by No. 11 gage by $\frac{7}{16}$ " head galvanized nails at 8" on center. Siding nailed with 7d galvanized smooth box nails.	—	—	—	Varies
	15-1.2 <sup>h, m</sup>	2" × 4" wood studs 16" on center with metal lath and $\frac{3}{4}$ " cement plaster on each side. Lath attached with 6d common nails 7" on center driven to 1" minimum penetration and bent over. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	5 $\frac{3}{8}$
	15-1.3 <sup>h, m</sup>	2" × 4" wood studs 16" on center with $\frac{7}{8}$ " cement plaster (measured from the face of studs) on the exterior surface with interior surface treatment as required for interior wood stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies
	15-1.4	3 $\frac{5}{8}$ " No. 16 gage noncombustible studs 16" on center with $\frac{7}{8}$ " cement plaster (measured from the face of the studs) on the exterior surface with interior surface treatment as required for interior, nonbearing, noncombustible stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies <sup>d</sup>

(continued)

**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.5 <sup>m</sup>	2 <sup>1</sup> / <sub>4</sub> " × 3 <sup>3</sup> / <sub>4</sub> " clay face brick with cored holes over 1/2" gypsum sheathing on exterior surface of 2" × 4" wood studs at 16" on center and two layers 5/8" Type X gypsum wallboard <sup>c</sup> on interior surface. Sheathing placed horizontally or vertically with vertical joints over studs nailed 6" on center with 1 <sup>3</sup> / <sub>4</sub> " × No. 11 gage by 7/16" head galvanized nails. Inner layer of wallboard placed horizontally or vertically and nailed 8" on center with 6d cooler <sup>n</sup> or wallboard <sup>n</sup> nails. Outer layer of wallboard placed horizontally or vertically and nailed 8" on center with 8d cooler <sup>n</sup> or wallboard <sup>n</sup> nails. All joints staggered with vertical joints over studs. Outer layer joints taped and finished with compound. Nail heads covered with joint compound. 0.035 inch (No. 20 galvanized sheet gage) corrugated galvanized steel wall ties 3/4" by 6 <sup>5</sup> / <sub>8</sub> " attached to each stud with two 8d cooler <sup>n</sup> or wallboard <sup>n</sup> nails every sixth course of bricks.	—	—	10	—
	15-1.6 <sup>l, m</sup>	2" × 6" fire-retardant-treated wood studs 16" on center. Interior face has two layers of 5/8" Type X gypsum with the base layer placed vertically and attached with 6d box nails 12" on center. The face layer is placed horizontally and attached with 8d box nails 8" on center at joints and 12" on center elsewhere. The exterior face has a base layer of 5/8" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by self-furred exterior lath attached with 2 <sup>1</sup> / <sub>2</sub> ", No. 12 gage galvanized roofing nails with a 3/8" diameter head and spaced 6" on center along each stud. Cement plaster consisting of a 1/2" brown coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with 10 pounds of hydrated lime and 3 pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1:4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat.	—	—	8 <sup>1</sup> / <sub>4</sub>	—
	15-1.7 <sup>l, m</sup>	2" × 6" wood studs 16" on center. The exterior face has a layer of 5/8" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by 1" by No. 18 gage self-furred exterior lath attached with 8d by 2 <sup>1</sup> / <sub>2</sub> " long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a 1/2" scratch coat, a bonding agent and a 1/2" brown coat and a finish coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with 10 pounds of hydrated lime and 3 pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1:4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat. The interior is covered with 3/8" gypsum lath with 1" hexagonal mesh of 0.035 inch (No. 20 B.W. gage) woven wire lath furred out 5/16" and 1" perlite or vermiculite gypsum plaster. Lath nailed with 1 <sup>1</sup> / <sub>8</sub> " by No. 13 gage by 19/64" head plasterboard glued nails spaced 5" on center. Mesh attached by 1 <sup>3</sup> / <sub>4</sub> " by No. 12 gage by 3/8" head nails with 3/8" furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to 2 <sup>1</sup> / <sub>2</sub> cubic feet of aggregate.	—	—	8 <sup>3</sup> / <sub>8</sub>	—

(continued)

**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.8 <sup>l, m</sup>	2" × 6" wood studs 16" on center. The exterior face has a layer of $\frac{5}{8}$ " Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by $1\frac{1}{2}$ " by No. 17 gage self-furred exterior lath attached with 8d by $2\frac{1}{2}$ " long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a $\frac{1}{2}$ " scratch coat, and a $\frac{1}{2}$ " brown coat is then applied. The plaster may be placed by machine. The scratch coat is mixed in the proportion of 1:4 by weight, plastic cement to sand. The brown coat is mixed in the proportion of 1:5 by weight, plastic cement to sand. The interior is covered with $\frac{3}{8}$ " gypsum lath with 1" hexagonal mesh of No. 20 gage woven wire lath furred out $\frac{5}{16}$ " and 1" perlite or vermiculite gypsum plaster. Lath nailed with $1\frac{1}{8}$ " by No. 13 gage by $\frac{19}{64}$ " head plasterboard glued nails spaced 5" on center. Mesh attached by $1\frac{3}{4}$ " by No. 12 gage by $\frac{3}{8}$ " head nails with $\frac{3}{8}$ " furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to $2\frac{1}{2}$ cubic feet of aggregate.	—	—	$8\frac{3}{8}$	—
	15-1.9	4" No. 18 gage, nonload-bearing metal studs, 16" on center, with 1" Portland cement lime plaster [measured from the back side of the $\frac{3}{4}$ -pound expanded metal lath] on the exterior surface. Interior surface to be covered with 1" of gypsum plaster on $\frac{3}{4}$ -pound expanded metal lath proportioned by weight-1:2 for scratch coat, 1:3 for brown, gypsum to sand. Lath on one side of the partition fastened to $\frac{1}{4}$ " diameter pencil rods supported by No. 20 gage metal clips, located 16" on center vertically, on each stud. 3" thick mineral fiber insulating batts friction fitted between the studs.	—	—	$6\frac{1}{2}$ <sup>d</sup>	—
	15-1.10	Steel studs 0.060" thick, 4" deep or 6" at 16" or 24" centers, with $\frac{1}{2}$ " Glass Fiber Reinforced Concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24" on center, with 5" leg welded to studs with two $\frac{1}{2}$ "-long flare-bevel welds, and 4" foot attached to the GFRC skin with $\frac{5}{8}$ " thick GFRC bonding pads that extend $2\frac{1}{2}$ " beyond the flex anchor foot on both sides. Interior surface to have two layers of $\frac{1}{2}$ " Type X gypsum wallboard. <sup>e</sup> The first layer of wallboard to be attached with 1"-long Type S buglehead screws spaced 24" on center and the second layer is attached with $1\frac{5}{8}$ "-long Type S screws spaced at 12" on center. Cavity is to be filled with 5" of 4 pcf (nominal) mineral fiber batts. GFRC has $1\frac{1}{2}$ " returns packed with mineral fiber and caulked on the exterior.	—	—	$6\frac{1}{2}$	—
	15-1.11	Steel studs 0.060" thick, 4" deep or 6" at 16" or 24" centers, respectively, with $\frac{1}{2}$ " Glass Fiber Reinforced Concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24" on center, with 5" leg welded to studs with two $\frac{1}{2}$ "-long flare-bevel welds, and 4" foot attached to the GFRC skin with $\frac{5}{8}$ " -thick GFRC bonding pads that extend $2\frac{1}{2}$ " beyond the flex anchor foot on both sides. Interior surface to have one layer of $\frac{5}{8}$ " Type X gypsum wallboard <sup>e</sup> , attached with $1\frac{1}{4}$ "-long Type S buglehead screws spaced 12" on center. Cavity is to be filled with 5" of 4 pcf (nominal) mineral fiber batts. GFRC has $1\frac{1}{2}$ " returns packed with mineral fiber and caulked on the exterior.	—	—	—	$6\frac{1}{8}$
	15-1.12 <sup>q</sup>	2" × 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with $\frac{5}{8}$ " Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 12" on center. Cavity to be filled with $5\frac{1}{2}$ " mineral wool insulation.	—	—	—	$6\frac{3}{4}$

(continued)



**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS<sup>a, c, p</sup>**

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.13 <sup>q</sup>	2" × 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with $\frac{5}{8}$ " Type X gypsum wallboard, 4' wide, applied vertically with all joints over framing or blocking and fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 12" on center. R-19 mineral fiber insulation installed in stud cavity.	—	—	—	6 $\frac{3}{4}$
	15-1.14 <sup>q</sup>	2" × 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with $\frac{5}{8}$ " Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 7" on center.	—	—	—	6 $\frac{3}{4}$
	15-1.15 <sup>q</sup>	2" × 4" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with $\frac{5}{8}$ " Type X gypsum wallboard and sheathing, respectively, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 12" on center. Cavity to be filled with 3 $\frac{1}{2}$ " mineral wool insulation.	—	—	—	4 $\frac{3}{4}$
	15-1.16 <sup>q</sup>	2" × 6" wood studs at 24" centers with double top plates, single bottom plate; interior and exterior side covered with two layers of $\frac{5}{8}$ " Type X gypsum wallboard, 4' wide, applied horizontally with vertical joints over studs. Base layer fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 24" on center and face layer fastened with Type S drywall screws, spaced 8" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Cavity to be filled with 5 $\frac{1}{2}$ " mineral wool insulation.	—	—	8	—
	15-2.1 <sup>d</sup>	3 $\frac{5}{8}$ " No. 16 gage steel studs at 24" on center or 2" × 4" wood studs at 24" on center. Metal lath attached to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center and covered with minimum $\frac{3}{4}$ " thick Portland cement plaster. Thin veneer brick units of clay or shale complying with ASTM C 1088, Grade TBS or better, installed in running bond in accordance with Section 1405.10. Combined total thickness of the Portland cement plaster, mortar and thin veneer brick units shall be not less than 1 $\frac{3}{4}$ ". Interior side covered with one layer of $\frac{5}{8}$ " thick Type X gypsum wallboard attached to studs with 1" long No. 6 drywall screws at 12" on center.	—	—	—	6
	15-2.2 <sup>d</sup>	3 $\frac{5}{8}$ " No. 16 gage steel studs at 24" on center or 2" × 4" wood studs at 24" on center. Metal lath attached to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center and covered with minimum $\frac{3}{4}$ " thick Portland cement plaster. Thin veneer brick units of clay or shale complying with ASTM C 1088, Grade TBS or better, installed in running bond in accordance with Section 1405.10. Combined total thickness of the Portland cement plaster, mortar and thin veneer brick units shall be not less than 2". Interior side covered with two layers of $\frac{5}{8}$ " thick Type X gypsum wallboard. Bottom layer attached to studs with 1" long No. 6 drywall screws at 24" on center. Top layer attached to studs with 1 $\frac{5}{8}$ " long No. 6 drywall screws at 12" on center.	—	—	6 $\frac{7}{8}$	—
	15-2.3 <sup>d</sup>	3 $\frac{5}{8}$ " No. 16 gage steel studs at 16" on center or 2" × 4" wood studs at 16" on center. Where metal lath is used, attach to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center. Brick units of clay or shale not less than 2 $\frac{5}{8}$ " thick complying with ASTM C 216 installed in accordance with Section 1405.6 with a minimum 1" air space. Interior side covered with one layer of $\frac{5}{8}$ " thick Type X gypsum wallboard attached to studs with 1" long No. 6 drywall screws at 12" on center.	—	—	—	7 $\frac{7}{8}$

(continued)

# FIRE AND SMOKE PROTECTION FEATURES

**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS** <sup>a, o, p</sup>

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE <sup>b</sup> (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls	15-2.4 <sup>d</sup>	3 <sup>5</sup> / <sub>8</sub> " No. 16 gage steel studs at 16" on center or 2" × 4" wood studs at 16" on center. Where metal lath is used, attach to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center. Brick units of clay or shale not less than 2 <sup>5</sup> / <sub>8</sub> " thick complying with ASTM C 216 installed in accordance with Section 1405.6 with a minimum 1" air space. Interior side covered with two layers of 5 <sup>5</sup> / <sub>8</sub> " thick Type X gypsum wallboard. Bottom layer attached to studs with 1" long No. 6 drywall screws at 24" on center. Top layer attached to studs with 1 <sup>5</sup> / <sub>8</sub> " long No. 6 drywall screws at 12" on center.	—	—	8 <sup>1</sup> / <sub>2</sub>	—
16. Exterior walls rated for fire resistance from the inside only in accordance with Section 705.5.	16-1.1 <sup>a</sup>	2" × 4" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum wallboard, 4" wide, applied horizontally unblocked, and fastened with 2 <sup>1</sup> / <sub>4</sub> " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Exterior covered with 3 <sup>3</sup> / <sub>8</sub> " wood structural panels, applied vertically, horizontal joints blocked and fastened with 6d common nails (bright) — 12" on center in the field, and 6" on center panel edges. Cavity to be filled with 3 <sup>1</sup> / <sub>2</sub> " mineral wool insulation. Rating established for exposure from interior side only.	—	—	—	4 <sup>1</sup> / <sub>2</sub>
	16-1.2 <sup>a</sup>	2" × 6" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum wallboard, 4" wide, applied horizontally or vertically with vertical joints over studs and fastened with 2 <sup>1</sup> / <sub>4</sub> " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound, exterior side covered with 7 <sup>1</sup> / <sub>16</sub> " wood structural panels fastened with 6d common nails (bright) spaced 12" on center in the field and 6" on center along the panel edges. Cavity to be filled with 5 <sup>1</sup> / <sub>2</sub> " mineral wool insulation. Rating established from the gypsum-covered side only.	—	—	—	6 <sup>9</sup> / <sub>16</sub>
	16-1.3 <sup>a</sup>	2" × 6" wood studs at 16" centers with double top plates, single bottom plates; interior side covered with 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum wallboard, 4" wide, applied vertically with all joints over framing or blocking and fastened with 2 <sup>1</sup> / <sub>4</sub> " Type S drywall screws spaced 7" on center. Joints to be covered with tape and joint compound. Exterior covered with 3 <sup>3</sup> / <sub>8</sub> " wood structural panels, applied vertically with edges over framing or blocking and fastened with 6d common nails (bright) at 12" on center in the field and 6" on center on panel edges. R-19 mineral fiber insulation installed in stud cavity. Rating established from the gypsum-covered side only.	—	—	—	6 <sup>1</sup> / <sub>2</sub>

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm<sup>2</sup>, 1 cubic foot = 0.0283 m<sup>3</sup>.

- Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.
- Thickness shown for brick and clay tile is nominal thicknesses unless plastered, in which case thicknesses are net. Thickness shown for concrete masonry and clay masonry is equivalent thickness defined in Section 722.3.1 for concrete masonry and Section 722.4.1.1 for clay masonry. Where all cells are solid grouted or filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, the equivalent thickness shall be the thickness of the block or brick using specified dimensions as defined in Chapter 21. Equivalent thickness may also include the thickness of applied plaster and lath or gypsum wallboard, where specified.
- For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is at least 75 percent of the gross cross-sectional area measured in the same plane.
- Shall be used for nonbearing purposes only.
- For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with a minimum of 1<sup>1</sup>/<sub>16</sub>-inch gypsum veneer plaster.
- The fire-resistance time period for concrete masonry units meeting the equivalent thicknesses required for a 2-hour fire-resistance rating in Item 3, and having a thickness of not less than 7<sup>5</sup>/<sub>8</sub> inches is 4 hours when cores which are not grouted are filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, sand or slag having a maximum particle size of 3<sup>3</sup>/<sub>8</sub> inch.
- The fire-resistance rating of concrete masonry units composed of a combination of aggregate types or where plaster is applied directly to the concrete masonry shall be determined in accordance with ACI 216.1/TMS 0216. Lightweight aggregates shall have a maximum combined density of 65 pounds per cubic foot.

*(continued)*

**TABLE 721.1(2)—continued**  
**RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS<sup>a, o</sup>**

- h. See also Note b. The equivalent thickness shall be permitted to include the thickness of cement plaster or 1.5 times the thickness of gypsum plaster applied in accordance with the requirements of Chapter 25.
- i. Concrete walls shall be reinforced with horizontal and vertical temperature reinforcement as required by Chapter 19.
- j. Studs are welded truss wire studs with 0.18 inch (No. 7 B.W. gage) flange wire and 0.18 inch (No. 7 B.W. gage) truss wires.
- k. Nailable metal studs consist of two channel studs spot welded back to back with a crimped web forming a nailing groove.
- l. Wood structural panels shall be permitted to be installed between the fire protection and the wood studs on either the interior or exterior side of the wood frame assemblies in this table, provided the length of the fasteners used to attach the fire protection is increased by an amount at least equal to the thickness of the wood structural panel.
- m. For studs with a slenderness ratio,  $l_{e/d}$ , greater than 33, the design stress shall be reduced to 78 percent of allowable  $F'_c$ . For studs with a slenderness ratio,  $l_{e/d}$ , not exceeding 33, the design stress shall be reduced to 78 percent of the adjusted stress  $F'_c$  calculated for studs having a slenderness ratio  $l_{e/d}$  of 33.
- n. For properties of cooler or wallboard nails, see ASTM C 514, ASTM C 547 or ASTM F 1667.
- o. Generic fire-resistance ratings (those not designated as PROPRIETARY\* in the listing) in the GA 600 shall be accepted as if herein listed.
- p. NCMA TEK 5-8A shall be permitted for the design of fire walls.
- q. The design stress of studs shall be equal to a maximum of 100 percent of the allowable  $F'_c$  calculated in accordance with Section 2306.

**TABLE 721.1(3)**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
1. Siliceous aggregate concrete	1-1.1	Slab (no ceiling required). Minimum cover over nonprestressed reinforcement shall not be less than $\frac{3}{4}$ " <sup>b</sup> .	7.0	6.2	5.0	3.5	—	—	—	—
2. Carbonate aggregate concrete	2-1.1		6.6	5.7	4.6	3.2	—	—	—	—
3. Sand-light-weight concrete	3-1.1		5.4	4.6	3.8	2.7	—	—	—	—
4. Lightweight concrete	4-1.1		5.1	4.4	3.6	2.5	—	—	—	—
5. Reinforced concrete	5-1.1	Slab with suspended ceiling of vermiculite gypsum plaster over metal lath attached to $\frac{3}{4}$ " cold-rolled channels spaced 12" on center. Ceiling located 6" minimum below joists.	3	2	—	—	1	$\frac{3}{4}$	—	—
	5-2.1	$\frac{3}{8}$ " Type X gypsum wallboard <sup>c</sup> attached to 0.018 inch (No. 25 carbon sheet steel gage) by $\frac{7}{8}$ " deep by $2\frac{5}{8}$ " hat-shaped galvanized steel channels with 1"-long No. 6 screws. The channels are spaced 24" on center, span 35" and are supported along their length at 35" intervals by 0.033" (No. 21 galvanized sheet gage) galvanized steel flat strap hangers having formed edges that engage the lips of the channel. The strap hangers are attached to the side of the concrete joists with $\frac{5}{32}$ " by $1\frac{1}{4}$ " long power-driven fasteners. The wallboard is installed with the long dimension perpendicular to the channels. All end joints occur on channels and supplementary channels are installed parallel to the main channels, 12" each side, at end joint occurrences. The finished ceiling is located approximately 12" below the soffit of the floor slab.	—	—	$2\frac{1}{2}$	—	—	—	$\frac{5}{8}$	—

(continued)

**FIRE AND SMOKE PROTECTION FEATURES**

**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
6. Steel joists constructed with a poured reinforced concrete slab on metal lath forms or steel form units <sup>d, e</sup>	6-1.1	Gypsum plaster on metal lath attached to the bottom cord with single No. 16 gage or doubled No. 18 gage wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat, by weight, gypsum-to-sand aggregate for 2-hour system. For 3-hour system plaster is neat.	—	—	2 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>4</sub>	—	—	3 <sup>3</sup> / <sub>4</sub>	5 <sup>5</sup> / <sub>8</sub>
	6-2.1	Vermiculite gypsum plaster on metal lath attached to the bottom chord with single No.16 gage or doubled 0.049-inch (No. 18 B.W. gage) wire ties 6" on center.	—	2	—	—	—	5 <sup>5</sup> / <sub>8</sub>	—	—
	6-3.1	Cement plaster over metal lath attached to the bottom chord of joists with single No. 16 gage or doubled 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat for 1-hour system and 1:1 for scratch coat, 1:1 1/2 for brown coat for 2-hour system, by weight, cement to sand.	—	—	—	2	—	—	—	5 <sup>5</sup> / <sub>8</sub> <sup>f</sup>
	6-4.1	Ceiling of 5 <sup>5</sup> / <sub>8</sub> " Type X wallboard <sup>c</sup> attached to 7 <sup>7</sup> / <sub>8</sub> " deep by 2 <sup>5</sup> / <sub>8</sub> " by 0.021 inch (No. 25 carbon sheet steel gage) hat-shaped furring channels 12" on center with 1" long No. 6 wallboard screws at 8" on center. Channels wire tied to bottom chord of joists with doubled 0.049 inch (No. 18 B.W. gage) wire or suspended below joists on wire hangers. <sup>g</sup>	—	—	2 <sup>1</sup> / <sub>2</sub>	—	—	—	5 <sup>5</sup> / <sub>8</sub>	—
	6-5.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied over metal lath. Lath tied 6" on center to 3 <sup>3</sup> / <sub>4</sub> " channels spaced 13 <sup>1</sup> / <sub>2</sub> " on center. Channels secured to joists at each intersection with two strands of 0.049 inch (No. 18 B.W. gage) galvanized wire.	—	—	2 <sup>1</sup> / <sub>2</sub>	—	—	—	3 <sup>3</sup> / <sub>4</sub>	—
7. Reinforced concrete slabs and joists with hollow clay tile fillers laid end to end in rows 2 <sup>1</sup> / <sub>2</sub> " or more apart; reinforcement placed between rows and concrete cast around and over tile.	7-1.1	5 <sup>5</sup> / <sub>8</sub> " gypsum plaster on bottom of floor or roof construction.	—	—	8 <sup>h</sup>	—	—	—	5 <sup>5</sup> / <sub>8</sub>	—
	7-1.2	None	—	—	—	5 <sup>1</sup> / <sub>2</sub> <sup>i</sup>	—	—	—	—
8. Steel joists constructed with a reinforced concrete slab on top poured on a 1 <sup>1</sup> / <sub>2</sub> " deep steel deck. <sup>e</sup>	8-1.1	Vermiculite gypsum plaster on metal lath attached to 3 <sup>3</sup> / <sub>4</sub> " cold-rolled channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center.	2 <sup>1</sup> / <sub>2</sub> <sup>j</sup>	—	—	—	3 <sup>3</sup> / <sub>4</sub>	—	—	—

*(continued)*

**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
9. 3" deep cellular steel deck with concrete slab on top. Slab thickness measured to top.	9-1.1	Suspended ceiling of vermiculite gypsum plaster base coat and vermiculite acoustical plaster on metal lath attached at 6" intervals to $\frac{3}{4}$ " cold-rolled channels spaced 12" on center and secured to $1\frac{1}{2}$ " cold-rolled channels spaced 36" on center with 0.065" (No. 16 B.W. gage) wire. $1\frac{1}{2}$ " channels supported by No. 8 gage wire hangers at 36" on center. Beams within envelope and with a $2\frac{1}{2}$ " airspace between beam soffit and lath have a 4-hour rating.	$2\frac{1}{2}$	—	—	—	$1\frac{1}{8}$ <sup>k</sup>	—	—	—
10. $1\frac{1}{2}$ "-deep steel roof deck on steel framing. Insulation board, 30 pcf density, composed of wood fibers with cement binders of thickness shown bonded to deck with unified asphalt adhesive. Covered with a Class A or B roof covering.	10-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to $\frac{3}{4}$ " furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. $\frac{3}{4}$ " channel saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle-tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	$1\frac{7}{8}$	1	—	—	$\frac{3}{4}$ <sup>l</sup>	$\frac{3}{4}$ <sup>l</sup>
11. $1\frac{1}{2}$ "-deep steel roof deck on steel-framing wood fiber insulation board, 17.5 pcf density on top applied over a 15-lb asphalt-saturated felt. Class A or B roof covering.	11-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to $\frac{3}{4}$ " furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. $\frac{3}{4}$ " channels saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, gypsum-to-sand aggregate for 1-hour system. For 2-hour system, plaster mix is 1:2 by weight, gypsum-to-sand aggregate.	—	—	$1\frac{1}{2}$	1	—	—	$\frac{7}{8}$ <sup>g</sup>	$\frac{3}{4}$ <sup>l</sup>

(continued)

**FIRE AND SMOKE PROTECTION FEATURES**

**TABLE 721.1(3) —continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
12. 1½" deep steel roof deck on steel-framing insulation of rigid board consisting of expanded perlite and fibers impregnated with integral asphalt waterproofing; density 9 to 12 pcf secured to metal roof deck by ½" wide ribbons of waterproof, cold-process liquid adhesive spaced 6" apart. Steel joist or light steel construction with metal roof deck, insulation, and Class A or B built-up roof covering. <sup>e</sup>	12-1.1	Gypsum-vermiculite plaster on metal lath wire tied at 6" intervals to ¾" furring channels spaced 12" on center and wire tied to 2" runner channels spaced 32" on center. Runners wire tied to bottom chord of steel joists.	—	—	1	—	—	—	7/8	—
13. Double wood floor over wood joists spaced 16" on center. <sup>m, n</sup>	13-1.1	Gypsum plaster over 3/8" Type X gypsum lath. Lath initially applied with not less than four 1½" by No. 13 gage by 19/64" head plasterboard blue nails per bearing. Continuous stripping over lath along all joist lines. Stripping consists of 3" wide strips of metal lath attached by 1½" by No. 11 gage by ½" head roofing nails spaced 6" on center. Alternate stripping consists of 3" wide 0.049" diameter wire stripping weighing 1 pound per square yard and attached by No.16 gage by 1½" by 3/4" crown width staples, spaced 4" on center. Where alternate stripping is used, the lath nailing may consist of two nails at each end and one nail at each intermediate bearing. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	—	—	—	—	—	7/8
	13-1.2	Cement or gypsum plaster on metal lath. Lath fastened with 1½" by No. 11 gage by 7/16" head barbed shank roofing nails spaced 5" on center. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, cement to sand aggregate.	—	—	—	—	—	—	—	5/8
	13-1.3	Perlite or vermiculite gypsum plaster on metal lath secured to joists with 1½" by No. 11 gage by 7/16" head barbed shank roofing nails spaced 5" on center.	—	—	—	—	—	—	—	5/8
	13-1.4	½" Type X gypsum wallboard <sup>e</sup> nailed to joists with 5d cooler <sup>o</sup> or wallboard <sup>o</sup> nails at 6" on center. End joints of wallboard centered on joists.	—	—	—	—	—	—	—	1/2

(continued)

**TABLE 721.1(3) —continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
14. Plywood stressed skin panels consisting of $\frac{5}{8}$ " - thick interior C-D (exterior glue) top stressed skin on 2" $\times$ 6" nominal (minimum) stringers. Adjacent panel edges joined with 8d common wire nails spaced 6" on center. Stringers spaced 12" maximum on center.	14-1.1	$\frac{1}{2}$ " -thick wood fiberboard weighing 15 to 18 pounds per cubic foot installed with long dimension parallel to stringers or $\frac{3}{8}$ " C-D (exterior glue) plywood glued and/or nailed to stringers. Nailing to be with 5d cooler <sup>o</sup> or wallboard <sup>o</sup> nails at 12" on center. Second layer of $\frac{1}{2}$ " Type X gypsum wallboard <sup>c</sup> applied with long dimension perpendicular to joists and attached with 8d cooler <sup>o</sup> or wallboard <sup>o</sup> nails at 6" on center at end joints and 8" on center elsewhere. Wall-board joints staggered with respect to fiberboard joints.	—	—	—	—	—	—	—	1
15. Vermiculite concrete slab proportioned 1:4 (Portland cement to vermiculite aggregate) on a $1\frac{1}{2}$ " -deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019 inch (No. 26 carbon steel sheet gage) or greater. Slab reinforced with 4" $\times$ 8" 0.109/0.083" (No. $\frac{12}{14}$ B.W. gage) welded wire mesh.	15-1.1	None	—	—	—	3 <sup>j</sup>	—	—	—	—
16. Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on a $1\frac{1}{4}$ " -deep steel deck supported on individually protected steel framing. Slab reinforced with 4" $\times$ 8" 0.109/0.083" (No. $\frac{12}{14}$ B.W. gage) welded wire mesh.	16-1.1	None	—	—	—	$3\frac{1}{2}$ <sup>j</sup>	—	—	—	—

(continued)

**FIRE AND SMOKE PROTECTION FEATURES**

**TABLE 721.1(3)—continued  
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
17. Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on a $\frac{9}{16}$ " -deep steel deck supported by steel joists 4' on center. Class A or B roof covering on top.	17-1.1	Perlite gypsum plaster on metal lath wire tied to $\frac{3}{4}$ " furring channels attached with 0.065" (No. 16 B.W. gage) wire ties to lower chord of joists.	—	2 <sup>p</sup>	2 <sup>p</sup>	—	—	$\frac{7}{8}$	$\frac{3}{4}$	—
18. Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on 1 $\frac{1}{4}$ " -deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019" (No. 26 carbon sheet steel gage) and 8'-0" where deck is 0.019" (No. 26 carbon sheet steel gage) or greater. Slab reinforced with 0.042" (No. 19 B.W. gage) hexagonal wire mesh. Class A or B roof covering on top.	18-1.1	None	—	2 $\frac{1}{4}$ " <sup>p</sup>	2 $\frac{1}{4}$ " <sup>p</sup>	—	—	—	—	—
19. Floor and beam construction consisting of 3" -deep cellular steel floor unit mounted on steel members with 1:4 (proportion of Portland cement to perlite aggregate) perlite-concrete floor slab on top.	19-1.1	Suspended envelope ceiling of perlite gypsum plaster on metal lath attached to $\frac{3}{4}$ " cold-rolled channels, secured to 1 $\frac{1}{2}$ " cold-rolled channels spaced 42" on center supported by 0.203 inch (No. 6 B.W. gage) wire 36" on center. Beams in envelope with 3" minimum airspace between beam soffit and lath have a 4-hour rating.	2 <sup>p</sup>	—	—	—	1 <sup>l</sup>	—	—	—

*(continued)*



**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
20. Perlite concrete proportioned 1:6 (Portland cement to perlite aggregate) poured to $\frac{1}{8}$ " thickness above top of corrugations of $1\frac{5}{16}$ " -deep galvanized steel deck maximum span 8'-0" for 0.024" (No. 24 galvanized sheet gage) or 6?0" for 0.019" (No. 26 galvanized sheet gage) with deck supported by individually protected steel framing. Approved polystyrene foam plastic insulation board having a flame spread not exceeding 75 (1" to 4" thickness) with vent holes that approximate 3 percent of the board surface area placed on top of perlite slurry. A 2' by 4' insulation board contains six $2\frac{3}{4}$ " diameter holes. Board covered with $2\frac{1}{4}$ " minimum perlite concrete slab. Slab reinforced with mesh consisting of 0.042" (No. 19 B.W. gage) galvanized steel wire twisted together to form 2" hexagons with straight 0.065" (No. 16 B.W. gage) galvanized steel wire woven into mesh and spaced 3". Alternate slab reinforcement shall be permitted to consist of 4" x 8" , 0.109/0.238" (No. 12/4 B.W. gage), or 2" x 2" , 0.083/0.083" (No. 14/14 B.W. gage) welded wire fabric. Class A or B roof covering on top.	20-1.1	None	—	—	Varies	—	—	—	—	—
21. Wood joists, wood I-joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c. with $\frac{1}{2}$ " wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with 8d nails. The wood structural panel thickness shall not be less than nominal $\frac{1}{2}$ " nor less than required by Chapter 23.	21-1.1	Base layer $\frac{5}{8}$ " Type X gypsum wallboard applied at right angles to joist or truss 24" o.c. with $1\frac{1}{4}$ " Type S or Type W drywall screws 24" o.c. Face layer $\frac{5}{8}$ " Type X gypsum wallboard or veneer base applied at right angles to joist or truss through base layer with $1\frac{7}{8}$ " Type S or Type W drywall screws 12" o.c. at joints and intermediate joist or truss. Face layer Type G drywall screws placed 2" back on either side of face layer end joints, 12" o.c.	—	—	—	Varies	—	—	—	$1\frac{1}{4}$

(continued)

**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
22. Steel joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c. with 1/2" wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with No. 8 screws. The wood structural panel thickness shall not be less than nominal 1/2" nor less than required by Chapter 23.	22-1.1	Base layer 5/8" Type X gypsum board applied at right angles to steel framing 24" on center with 1" Type S drywall screws spaced 24" on center. Face layer 5/8" Type X gypsum board applied at right angles to steel framing attached through base layer with 1 5/8" Type S drywall screws 12" on center at end joints and intermediate joints and 1 1/2" Type G drywall screws 12 inches on center placed 2" back on either side of face layer end joints. Joints of the face layer are offset 24" from the joints of the base layer.	—	—	—	Varies	—	—	—	1 1/4
23. Wood I-joist (minimum joist depth 9 1/4" with a minimum flange depth of 1 5/16" and a minimum flange cross-sectional area of 2.3 square inches) at 24" o.c. spacing with 1 inch by 4 inch (nominal) wood furring strip spacer applied parallel to and covering the bottom of the bottom flange of each member, tacked in place. 2" mineral wool insulation, 3.5 pcf (nominal) installed adjacent to the bottom flange of the I-joist and supported by the 1" x 4" furring strip spacer.	23-1.1	1/2" deep single leg resilient channel 16" on center (channels doubled at wallboard end joints), placed perpendicular to the furring strip and joist and attached to each joist by 1 7/8" Type S drywall screws. 5/8" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered at least 4' and fastened with 1 1/8" Type S drywall screws spaced 7" on center. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	5/8
24. Wood I-joist (minimum I-joist depth 9 1/4" with a minimum flange depth of 1 1/2" and a minimum flange cross-sectional area of 5.25 square inches; minimum web thickness of 3/8") @ 24" o.c., 1 1/2" mineral wool insulation (2.5 pcf-nominal) resting on hat-shaped furring channels.	24-1.1	Minimum 0.026" thick hat-shaped channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 5/8" Type S drywall screws. 5/8" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered and fastened with 1 1/8" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. at the wallboard ends. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	5/8
25. Wood I-joist (minimum I-joist depth 9 1/4" with a minimum flange depth of 1 1/2" and a minimum flange cross-sectional area of 5.25 square inches; minimum web thickness of 7/16") @ 24" o.c., 1 1/2" mineral wool insulation (2.5 pcf-nominal) resting on resilient channels.	25-1.1	Minimum 0.019" thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 5/8" Type S drywall screws. 5/8" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered and fastened with 1" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. at the wallboard ends. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	5/8

(continued)

**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
26. Wood I-joist (minimum I-joist depth $9\frac{1}{4}$ " with a minimum flange thickness of $1\frac{1}{2}$ " and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of $\frac{3}{8}$ ") @ 24" o.c.	26-1.1	Two layers of $\frac{1}{2}$ " Type X gypsum wallboard applied with the long dimension perpendicular to the I-joists with end joints staggered. The base layer is fastened with $1\frac{5}{8}$ " Type S drywall screws spaced 12" o.c. and the face layer is fastened with 2" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. on the edges. Face layer end joints shall not occur on the same I-joist as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to also be attached to base layer with $1\frac{1}{2}$ " Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	1
27. Wood I-joist (minimum I-joist depth $9\frac{1}{2}$ " with a minimum flange depth of $1\frac{5}{16}$ " and a minimum flange cross-sectional area of 1.95 square inches; minimum web thickness of $\frac{3}{8}$ ") @ 24" o.c.	27-1.1	Minimum 0.019" thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by $1\frac{5}{8}$ " Type S drywall screws. Two layers of $\frac{1}{2}$ " Type X gypsum wallboard applied with the long dimension perpendicular to the I-joists with end joints staggered. The base layer is fastened with $1\frac{1}{4}$ " Type S drywall screws spaced 12" o.c. and the face layer is fastened with $1\frac{5}{8}$ " Type S drywall screws spaced 12" o.c. Face layer end joints shall not occur on the same I-joist as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to also be attached to base layer with $1\frac{1}{2}$ " Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	1

(continued)

**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
28. Wood I-joist (minimum I-joist depth 9 <sup>1</sup> / <sub>4</sub> " with a minimum flange depth of 1 <sup>1</sup> / <sub>2</sub> " and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of 3 <sup>3</sup> / <sub>8</sub> " ) @ 24" o.c. Unfaced fiberglass insulation is installed between the I-joists supported on the upper surface of the flange by stay wires spaced 12" o.c.	28-1.1	Base layer of 5 <sup>5</sup> / <sub>8</sub> " Type C gypsum wall-board attached directly to I-joists with 1 <sup>5</sup> / <sub>8</sub> " Type S drywall screws spaced 12" o.c. with ends staggered. Minimum 0.0179" thick hat-shaped 7 <sup>7</sup> / <sub>8</sub> -inch furring channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 <sup>5</sup> / <sub>8</sub> " Type S drywall screws after the base layer of gypsum wall-board has been applied. The middle and face layers of 5 <sup>5</sup> / <sub>8</sub> " Type C gypsum wall-board applied perpendicular to the channel with end joints staggered. The middle layer is fastened with 1" Type S drywall screws spaced 12" o.c. The face layer is applied parallel to the middle layer but with the edge joints offset 24" from those of the middle layer and fastened with 1 <sup>5</sup> / <sub>8</sub> " Type S drywall screws 8" o.c. The joints shall be taped and covered with joint compound.	—	—	—	Varies	—	—	2 <sup>3</sup> / <sub>4</sub>	—
29. Channel-shaped 18 gage steel joists (minimum depth 8" ) spaced a maximum 24" o.c. supporting tongue-and-groove wood structural panels (nominal minimum 3 <sup>3</sup> / <sub>4</sub> " thick) applied perpendicular to framing members. Structural panels attached with 1 <sup>5</sup> / <sub>8</sub> " Type S-12 screws spaced 12" o.c.	29-1.1	Base layer 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum board applied perpendicular to bottom of framing members with 1 <sup>1</sup> / <sub>8</sub> " Type S-12 screws spaced 12" o.c. Second layer 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum board attached perpendicular to framing members with 1 <sup>5</sup> / <sub>8</sub> " Type S-12 screws spaced 12" o.c. Second layer joints offset 24" from base layer. Third layer 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum board attached perpendicular to framing members with 2 <sup>3</sup> / <sub>8</sub> " Type S-12 screws spaced 12" o.c. Third layer joints offset 12" from second layer joints. Hat-shaped 7 <sup>7</sup> / <sub>8</sub> -inch rigid furring channels applied at right angles to framing members over third layer with two 2 <sup>3</sup> / <sub>8</sub> " Type S-12 screws at each framing member. Face layer 5 <sup>5</sup> / <sub>8</sub> " Type X gypsum board applied at right angles to furring channels with 1 <sup>1</sup> / <sub>8</sub> " Type S screws spaced 12" o.c.	—	—	Varies	—	—	—	3 <sup>3</sup> / <sub>8</sub>	—

(continued)

**TABLE 721.1(3)—continued**  
**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS<sup>a, q</sup>**

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m<sup>3</sup>,  
 1 pound per square inch = 6.895 kPa, 1 pound per linear foot = 1.4882 kg/m.

- a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.
- b. When the slab is in an unrestrained condition, minimum reinforcement cover shall not be less than 1<sup>5</sup>/<sub>8</sub> inches for 4 hours (siliceous aggregate only); 1<sup>1</sup>/<sub>4</sub> inches for 4 and 3 hours; 1 inch for 2 hours (siliceous aggregate only); and 3/4 inch for all other restrained and unrestrained conditions.
- c. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with a minimum of 1/16-inch gypsum veneer plaster.
- d. Slab thickness over steel joists measured at the joists for metal lath form and at the top of the form for steel form units.
- e. (a) The maximum allowable stress level for H-Series joists shall not exceed 22,000 psi.  
 (b) The allowable stress for K-Series joists shall not exceed 26,000 psi, the nominal depth of such joist shall not be less than 10 inches and the nominal joist weight shall not be less than 5 pounds per linear foot.
- f. Cement plaster with 15 pounds of hydrated lime and 3 pounds of approved additives or admixtures per bag of cement.
- g. Gypsum wallboard ceilings attached to steel framing shall be permitted to be suspended with 1<sup>1</sup>/<sub>2</sub>-inch cold-formed carrying channels spaced 48 inches on center, which are suspended with No. 8 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire (double strand) and spaced as required for direct attachment to the framing. This alternative is also applicable to those steel framing assemblies recognized under Note q.
- h. Six-inch hollow clay tile with 2-inch concrete slab above.
- i. Four-inch hollow clay tile with 1<sup>1</sup>/<sub>2</sub>-inch concrete slab above.
- j. Thickness measured to bottom of steel form units.
- k. Five-eighths inch of vermiculite gypsum plaster plus 1/2 inch of approved vermiculite acoustical plastic.
- l. Furring channels spaced 12 inches on center.
- m. Double wood floor shall be permitted to be either of the following:
  - (a) Subfloor of 1-inch nominal boarding, a layer of asbestos paper weighing not less than 14 pounds per 100 square feet and a layer of 1-inch nominal tongue-and-groove finished flooring; or
  - (b) Subfloor of 1-inch nominal tongue-and-groove boarding or 1<sup>5</sup>/<sub>32</sub>-inch wood structural panels with exterior glue and a layer of 1-inch nominal tongue-and-groove finished flooring or 1<sup>9</sup>/<sub>32</sub>-inch wood structural panel finish flooring or a layer of Type I Grade M-1 particleboard not less than 5/8-inch thick.
- n. The ceiling shall be permitted to be omitted over unusable space, and flooring shall be permitted to be omitted where unusable space occurs above.
- o. For properties of cooler or wallboard nails, see ASTM C 514, ASTM C 547 or ASTM F 1667.
- p. Thickness measured on top of steel deck unit.
- q. Generic fire-resistance ratings (those not designated as PROPRIETARY\* in the listing) in the GA 600 shall be accepted as if herein listed.

**721.1.5 Bonded prestressed concrete tendons.** For members having a single tendon or more than one tendon installed with equal concrete cover measured from the nearest surface, the cover shall not be less than that set forth in Table 721.1(1). For members having multiple tendons installed with variable concrete cover, the average tendon cover shall not be less than that set forth in Table 721.1(1), provided:

1. The clearance from each tendon to the nearest exposed surface is used to determine the average cover.
2. In no case can the clear cover for individual tendons be less than one-half of that set forth in Table 721.1(1). A minimum cover of 3/4 inch (19.1 mm) for slabs and 1 inch (25 mm) for beams is required for any aggregate concrete.
3. For the purpose of establishing a fire-resistance rating, tendons having a clear covering less than that set forth in Table 721.1(1) shall not contribute more than 50 percent of the required ultimate moment capacity for members less than 350 square inches (0.226 m<sup>2</sup>) in cross-sectional area and 65 percent for larger members. For structural design purposes, however, tendons having a reduced cover are assumed to be fully effective.

**721.2 Cellular concrete. [HCD 1 & HCD 2]**

**721.2.1 Use and application [HCD 1 & HCD 2]** *Controlled-density cellular concrete, when used or applied, shall be in accordance with the use of materials in Bulletin No. 65 of the Federal Housing Administration, United States Department of Housing and Urban Development.*

**Exceptions:**

1. *Regardless of the provisions of Subsections 3.2, 3.3, 3.4 and 3.6 in Section 3, Bulletin No. 65 provisions relating to proportioning, mixing and testing, in the following shall apply to this chapter.*

- 1.1. *Field-control weighings for control of the wet-unit weight shall be made. The design wet-unit weight for field control of the concrete shall be based on previously established data for the relation between the wet-unit weight and the air-dry-unit weight at 28 days for the mix being placed. Field-control weighings for determining the wet-unit weight shall be made at the mixer discharge and at the point of deposit. There should be one pair of weighings per batch for batch-type mixers unless equipment is provided with scales allowing the operator to adequately weigh materials.*

*For continuous weight-instrumented batch mixers, there should be one pair of weighings per 10 cubic yards (7.65 m<sup>3</sup>). The gain in unit weight between the mixer discharge and point*

of deposit shall not exceed 5 percent. The wet-unit weight at the point of deposit of the concrete shall not exceed plus 5 percent of the design wet-unit weight. A variation exceeding plus 5 percent of the design wet-unit weight shall require a modification of the mix proportions, a change of materials or a change in the mixing procedure.

- 1.2. When tests are required by the enforcing agency, they shall be performed in the following manner:

Two test cylinders, for compressive strength tests, shall be made for each 8,000 square feet (743 m<sup>2</sup>) of surface area placed. A minimum of two test cylinders shall be made each day. Each strength test result shall be the average of two cylinders from the same sample tested at 28 days or at a specified earlier date.

- 1.3. The minimum air-dry density shall be 90 pounds per cubic foot (1,440 kg/m<sup>3</sup>). The minimum design compressive strength shall be 1,000 psi (6,890 kPa) when the curing procedure specified herein is applied. The minimum design compressive strength shall be 1,250 psi (8,619 kPa) if the slab is placed in a covered area of a building and a specified curing medium is not applied. The specified design compressive strength shall be increased 20 percent when the specified strength is greater than 1,000 psi (6,890 kPa) and the slab is placed in a covered area of a building and a specified curing medium is not applied.

- 1.4. The cellular concrete shall be sampled at the point of deposit in accordance with the applicable procedures of ASTM C 172, Sampling Fresh Concrete. Cylinder molds shall be either 3 inches by 6 inches (76 mm by 152 mm) or 6 inches by 12 inches (152 mm by 305 mm). Lightly tap the sides of the mold with a rubber hammer while filling the mold instead of rodding the mix. Moist cure the specimens for seven days at 73.4°F (40.8°C) plus or minus 3°F (1.7°C). At the age of seven days, remove the specimens from the moist condition and store in a temperature of 73.4°F (40.8°C) plus or minus 3°F (1.7°C) and a relative humidity of 50 plus or minus 10 percent for 21 days; remove and air dry until the time of test at 28 days. The compressive strength test shall be in accordance with ASTM C 39, Compressive Strength of Cylindrical Concrete Specimens. Determine the air-dry-unit weight at 28 days.

2. Regardless of the provisions of Subsections 4.1 and 4.2 in Section 4 of Bulletin No. 65, relating to placing, finishing and curing, the following shall apply to these regulations.

- 2.1. The concrete shall be placed, finished and cured to produce a level, smooth surface. The

concrete shall be placed in a single layer to a minimum thickness of 1 1/2 inches (38 mm). The deviation from a plan shall not exceed 1/4 inch (6 mm) in any 10 feet (3048 mm). The final finish of the concrete shall be suitable for the application of the specified wear-resistant covering. Cracks wider than 1/8 inch (3 mm) shall be repaired.

- 2.2. Install a water-resistant membrane between wood or plywood subfloors and the cellular concrete to prevent leakage of the concrete and wetting of the subfloor. The membrane shall consist of waterproof paper or plastic sheets conforming to ASTM C 171, Sheet Materials for Curing Concrete, or Type 15 roofing felt conforming to ASTM D 226, D 250 or D 227, or Federal Specification UUB790, Building Paper Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire-resistant) Type 1, Grade B. The sheets shall be securely fastened to the subfloor.

3. Regardless of the provisions of Subsections 6.1 and 6.2 in Section 6, of Bulletin No. 65, relating to applicator qualifications and warranty, these subsections are omitted from this chapter.

## **SECTION 722 CALCULATED FIRE RESISTANCE**

**722.1 General.** The provisions of this section contain procedures by which the fire resistance of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in this section and shall not be otherwise used. The calculated fire resistance of concrete, concrete masonry and clay masonry assemblies shall be permitted in accordance with ACI 216.1/TMS 0216. The calculated fire resistance of steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 29. The calculated fire resistance of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AF&PA National Design Specification for Wood Construction (NDS).

**722.1.1 Definitions.** The following terms are defined in Chapter 2:

**CERAMIC FIBER BLANKET.**

**CONCRETE, CARBONATE AGGREGATE.**

**CONCRETE, CELLULAR.**

**CONCRETE, LIGHTWEIGHT AGGREGATE.**

**CONCRETE, PERLITE.**

**CONCRETE, SAND-LIGHTWEIGHT.**

**CONCRETE, SILICEOUS AGGREGATE.**

**CONCRETE, VERMICULITE.**

**GLASS FIBERBOARD.**

**MINERAL BOARD.**

**722.2 Concrete assemblies.** The provisions of this section contain procedures by which the fire-resistance ratings of concrete assemblies are established by calculations.

**722.2.1 Concrete walls.** Cast-in-place and precast concrete walls shall comply with Section 722.2.1.1. Multiwythe concrete walls shall comply with Section 722.2.1.2. Joints between precast panels shall comply with Section 722.2.1.3. Concrete walls with gypsum wallboard or plaster finish shall comply with Section 722.2.1.4.

**722.2.1.1 Cast-in-place or precast walls.** The minimum equivalent thicknesses of cast-in-place or precast concrete walls for fire-resistance ratings of 1 hour to 4 hours are shown in Table 722.2.1.1. For solid walls with flat vertical surfaces, the equivalent thickness is the same as the actual thickness. The values in Table 722.2.1.1 apply to plain, reinforced or prestressed concrete walls.

**722.2.1.1.1 Hollow-core precast wall panels.** For hollow-core precast concrete wall panels in which the cores are of constant cross section throughout the length, calculation of the equivalent thickness by dividing the net cross-sectional area (the gross cross section minus the area of the cores) of the panel by its width shall be permitted.

**TABLE 722.2.1.1  
MINIMUM EQUIVALENT THICKNESS OF CAST-IN-PLACE OR  
PRECAST CONCRETE WALLS, LOAD-BEARING OR  
NONLOAD-BEARING**

CONCRETE TYPE	MINIMUM SLAB THICKNESS (inches) FOR FIRE-RESISTANCE RATING OF				
	1 hour	1½ hours	2 hours	3 hours	4 hours
Siliceous	3.5	4.3	5.0	6.2	7.0
Carbonate	3.2	4.0	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

**722.2.1.1.2 Core spaces filled.** Where all of the core spaces of hollow-core wall panels are filled with

loose-fill material, such as expanded shale, clay, or slag, or vermiculite or perlite, the fire-resistance rating of the wall is the same as that of a solid wall of the same concrete type and of the same over all thickness.

**722.2.1.1.3 Tapered cross sections.** The thickness of panels with tapered cross sections shall be that determined at a distance  $2t$  or 6 inches (152 mm), whichever is less, from the point of minimum thickness, where  $t$  is the minimum thickness.

**722.2.1.1.4 Ribbed or undulating surfaces.** The equivalent thickness of panels with ribbed or undulating surfaces shall be determined by one of the following expressions:

For  $s \geq 4t$ , the thickness to be used shall be  $t$

For  $s \leq 2t$ , the thickness to be used shall be  $t_e$

For  $4t > s > 2t$ , the thickness to be used shall be

$$t + \left( \frac{4t}{s} - 1 \right) (t_e - t) \quad (\text{Equation 7-3})$$

where:

$s$  = Spacing of ribs or undulations.

$t$  = Minimum thickness.

$t_e$  = Equivalent thickness of the panel calculated as the net cross-sectional area of the panel divided by the width, in which the maximum thickness used in the calculation shall not exceed  $2t$ .

**722.2.1.2 Multiwythe walls.** For walls that consist of two wythes of different types of concrete, the fire-resistance ratings shall be permitted to be determined from Figure 722.2.1.2.

**722.2.1.2.1 Two or more wythes.** The fire-resistance rating for wall panels consisting of two or more wythes shall be permitted to be determined by the formula:

**TABLE 722.2.1.2(1)  
VALUES OF  $R_n^{0.59}$  FOR USE IN EQUATION 7-4**

TYPE OF MATERIAL	THICKNESS OF MATERIAL (inches)											
	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7
Siliceous aggregate concrete	5.3	6.5	8.1	9.5	11.3	13.0	14.9	16.9	18.8	20.7	22.8	25.1
Carbonate aggregate concrete	5.5	7.1	8.9	10.4	12.0	14.0	16.2	18.1	20.3	21.9	24.7	27.2 <sup>c</sup>
Sand-lightweight concrete	6.5	8.2	10.5	12.8	15.5	18.1	20.7	23.3	26.0 <sup>c</sup>	Note c	Note c	Note c
Lightweight concrete	6.6	8.8	11.2	13.7	16.5	19.1	21.9	24.7	27.8 <sup>c</sup>	Note c	Note c	Note c
Insulating concrete <sup>a</sup>	9.3	13.3	16.6	18.3	23.1	26.5 <sup>c</sup>	Note c	Note c	Note c	Note c	Note c	Note c
Airspace <sup>b</sup>	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m<sup>3</sup>.

a. Dry unit weight of 35 pcf or less and consisting of cellular, perlite or vermiculite concrete.

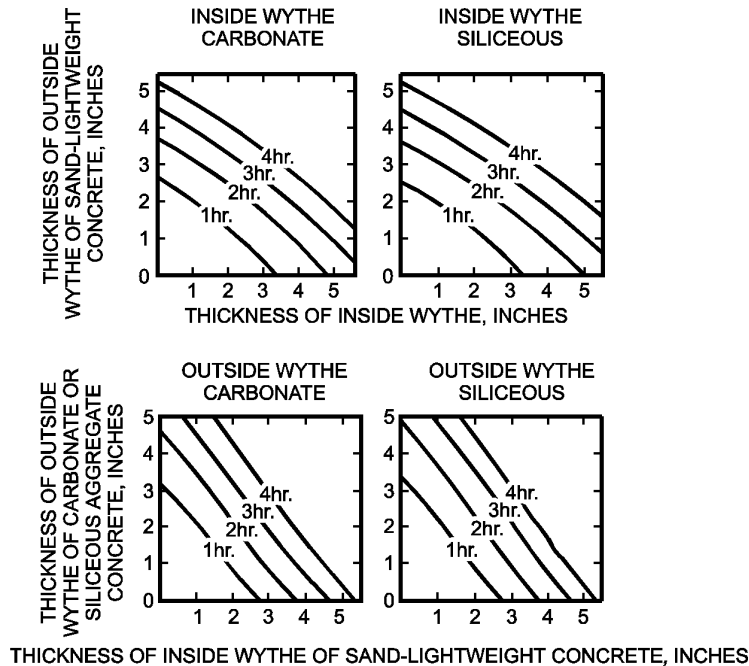
b. The  $R_n^{0.59}$  value for one ½" to 3½" airspace is 3.3. The  $R_n^{0.59}$  value for two ½" to 3½" airspaces is 6.7.

c. The fire-resistance rating for this thickness exceeds 4 hours.

TABLE 722.2.1.2(2)  
FIRE-RESISTANCE RATINGS BASED ON  $R^{0.59}$

$R^a$ , MINUTES	$R^{0.59}$
60	11.20
120	16.85
180	21.41
240	25.37

a. Based on Equation 7-4.



For SI: 1 inch = 25.4 mm.

FIGURE 722.2.1.2  
FIRE-RESISTANCE RATINGS OF TWO-WYTHER CONCRETE WALLS

$$R = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59})^{1.7} \quad (\text{Equation 7-4})$$

where:

$R$  = The fire endurance of the assembly, minutes.

$R_1$ ,  $R_2$ , and  $R_n$  = The fire endurances of the individual wythes, minutes. Values of  $R_n^{0.59}$  for use in Equation 7-4 are given in Table 722.2.1.2(1). Calculated fire-resistance ratings are shown in Table 722.2.1.2(2).

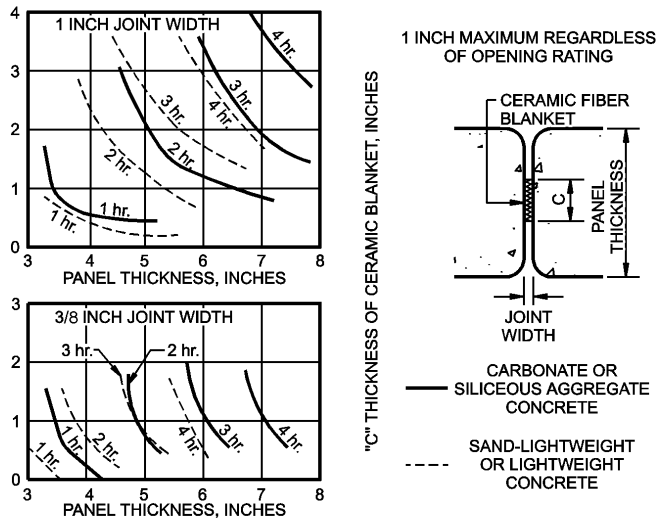
**722.2.1.2.2 Foam plastic insulation.** The fire-resistance ratings of precast concrete wall panels consisting of a layer of foam plastic insulation sandwiched between two wythes of concrete shall be permitted to be determined by use of Equation 7-4. Foam plastic insulation with a total thickness of less than 1 inch (25 mm) shall be disregarded. The  $R_n$  value for thickness of foam plastic insulation of 1 inch (25 mm) or greater, for use in the calculation, is 5 minutes; therefore  $R_n^{0.59} = 2.5$ .

**722.2.1.3 Joints between precast wall panels.** Joints between precast concrete wall panels which are not insulated as required by this section shall be

considered as openings in walls. Uninsulated joints shall be included in determining the percentage of openings permitted by Table 705.8. Where openings are not permitted or are required by this code to be protected, the provisions of this section shall be used to determine the amount of joint insulation required. Insulated joints shall not be considered openings for purposes of determining compliance with the allowable percentage of openings in Table 705.8.

**722.2.1.3.1 Ceramic fiber joint protection.** Figure 722.2.1.3.1 shows thicknesses of ceramic fiber blankets to be used to insulate joints between precast concrete wall panels for various panel thicknesses and for joint widths of  $\frac{3}{8}$  inch (9.5 mm) and 1 inch (25 mm) for fire-resistance ratings of 1 hour to 4 hours. For joint widths between  $\frac{3}{8}$  inch (9.5 mm) and 1 inch (25 mm), the thickness of ceramic fiber blanket is allowed to be determined by direct interpolation. Other tested and labeled materials are acceptable in place of ceramic fiber blankets.





For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.1.3.1**  
**CERAMIC FIBER JOINT PROTECTION**

**722.2.1.4 Walls with gypsum wallboard or plaster finishes.** The fire-resistance rating of cast-in-place or precast concrete walls with finishes of gypsum wallboard or plaster applied to one or both sides shall be permitted to be calculated in accordance with the provisions of this section.

**722.2.1.4.1 Nonfire-exposed side.** Where the finish of gypsum wallboard or plaster is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of the finish shall first be corrected by multiplying the actual thickness of the finish by the applicable factor determined from Table 722.2.1.4(1) based on the type of aggregate in the concrete. The corrected thickness of finish shall then be added to the actual or equivalent thickness of concrete and fire-resistance rating of the concrete and finish determined from Table 722.2.1.1, Figure 722.2.1.2 or Table 722.2.1.2(1).

**722.2.1.4.2 Fire-exposed side.** Where gypsum wallboard or plaster is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 722.2.1.4(2) shall be added to the fire-resistance rating determined from Table 722.2.1.1 or Figure 722.2.1.2, or Table 722.2.1.2(1) for the concrete alone, or to the rating determined in Section 722.2.1.4.1 for the concrete and finish on the non-fire-exposed side.

**722.2.1.4.3 Nonsymmetrical assemblies.** For a wall having no finish on one side or different types or thicknesses of finish on each side, the calculation procedures of Sections 722.2.1.4.1 and 722.2.1.4.2 shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-resistance rating of the wall shall not exceed the lower of the two values.

**Exception:** For an exterior wall with a fire separation distance greater than 5 feet (1524 mm) the fire shall be assumed to occur on the interior side only.

**722.2.1.4.4 Minimum concrete fire-resistance rating.** Where finishes applied to one or both sides of a concrete wall contribute to the fire-resistance rating, the concrete alone shall provide not less than one-half of the total required fire-resistance rating. Additionally, the contribution to the fire resistance of the finish on the nonfire-exposed side of a load-bearing wall shall not exceed one-half the contribution of the concrete alone.

**722.2.1.4.5 Concrete finishes.** Finishes on concrete walls that are assumed to contribute to the total fire-resistance rating of the wall shall comply with the installation requirements of Section 722.3.2.5.

**722.2.2 Concrete floor and roof slabs.** Reinforced and prestressed floors and roofs shall comply with Section 722.2.2.1. Multicourse floors and roofs shall comply with Sections 722.2.2.2 and 722.2.2.3, respectively.

**TABLE 722.2.1.4(1)**  
**MULTIPLYING FACTOR FOR FINISHES ON NONFIRE-EXPOSED SIDE OF WALL**

TYPE OF FINISH APPLIED TO CONCRETE OR CONCRETE MASONRY WALL	TYPE OF AGGREGATE USED IN CONCRETE OR CONCRETE MASONRY			
	Concrete: siliceous or carbonate Concrete Masonry: siliceous or carbonate; solid clay brick	Concrete: sand-lightweight Concrete Masonry: clay tile; hollow clay brick; concrete masonry units of expanded shale and < 20% sand	Concrete: lightweight Concrete Masonry: concrete masonry units of expanded shale, expanded clay, expanded slag, or pumice < 20% sand	Concrete Masonry: concrete masonry units of expanded slag, expanded clay, or pumice
Portland cement-sand plaster	1.00	0.75 <sup>a</sup>	0.75 <sup>a</sup>	0.50 <sup>a</sup>
Gypsum-sand plaster	1.25	1.00	1.00	1.00
Gypsum-vermiculite or perlite plaster	1.75	1.50	1.25	1.25
Gypsum wallboard	3.00	2.25	2.25	2.25

For SI: 1 inch = 25.4 mm.

a. For Portland cement-sand plaster  $\frac{5}{8}$  inch or less in thickness and applied directly to the concrete or concrete masonry on the nonfire-exposed side of the wall, the multiplying factor shall be 1.00.

## FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.2.1.4(2)**  
**TIME ASSIGNED TO FINISH MATERIALS ON FIRE-EXPOSED SIDE OF WALL**

FINISH DESCRIPTION	TIME (minutes)
Gypsum wallboard	
$\frac{3}{8}$ inch	10
$\frac{1}{2}$ inch	15
$\frac{5}{8}$ inch	20
2 layers of $\frac{3}{8}$ inch	25
1 layer $\frac{3}{8}$ inch, 1 layer $\frac{1}{2}$ inch	35
2 layers $\frac{1}{2}$ inch	40
Type X gypsum wallboard	
$\frac{1}{2}$ inch	25
$\frac{5}{8}$ inch	40
Portland cement-sand plaster applied directly to concrete masonry	See Note a
Portland cement-sand plaster on metal lath	
$\frac{3}{4}$ inch	20
$\frac{7}{8}$ inch	25
1 inch	30
Gypsum sand plaster on $\frac{3}{8}$ -inch gypsum lath	
$\frac{1}{2}$ inch	35
$\frac{5}{8}$ inch	40
$\frac{3}{4}$ inch	50
Gypsum sand plaster on metal lath	
$\frac{3}{4}$ inch	50
$\frac{7}{8}$ inch	60
1 inch	80

For SI: 1 inch = 25.4 mm.

- a. The actual thickness of Portland cement-sand plaster, provided it is  $\frac{5}{8}$  inch or less in thickness, shall be permitted to be included in determining the equivalent thickness of the masonry for use in Table 722.3.2.

**722.2.2.1 Reinforced and prestressed floors and roofs.** The minimum thicknesses of reinforced and prestressed concrete floor or roof slabs for fire-resistance ratings of 1 hour to 4 hours are shown in Table 722.2.2.1.

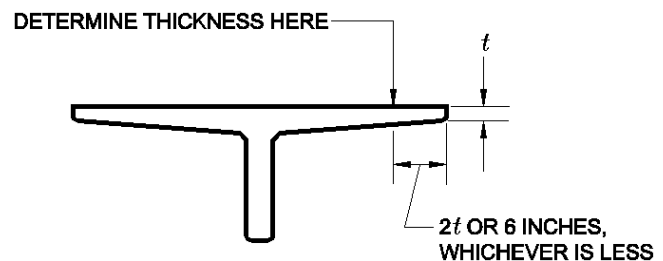
**TABLE 722.2.2.1**  
**MINIMUM SLAB THICKNESS (inches)**

CONCRETE TYPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
Siliceous	3.5	4.3	5	6.2	7
Carbonate	3.2	4	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

**722.2.2.1.1 Hollow-core prestressed slabs.** For hollow-core prestressed concrete slabs in which the cores are of constant cross section throughout the length, the equivalent thickness shall be permitted to be obtained by dividing the net cross-sectional area of the slab including grout in the joints, by its width.

**722.2.2.1.2 Slabs with sloping soffits.** The thickness of slabs with sloping soffits (see Figure 722.2.2.1.2) shall be determined at a distance  $2t$  or 6 inches (152 mm), whichever is less, from the point of minimum thickness, where  $t$  is the minimum thickness.



For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.2.1.2**  
**DETERMINATION OF SLAB THICKNESS**  
**FOR SLOPING SOFFITS**

**722.2.2.1.3 Slabs with ribbed soffits.** The thickness of slabs with ribbed or undulating soffits (see Figure 722.2.2.1.3) shall be determined by one of the following expressions, whichever is applicable:

For  $s > 4t$ , the thickness to be used shall be  $t$

For  $s \leq 2t$ , the thickness to be used shall be  $t_e$

For  $4t > s > 2t$ , the thickness to be used shall be

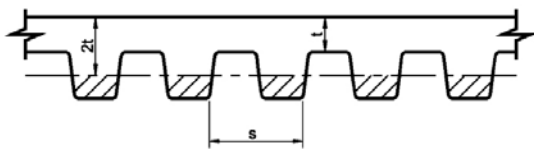
$$t + \left( \frac{4t}{s} - 1 \right) (t_e - t) \quad (\text{Equation 7-5})$$

where:

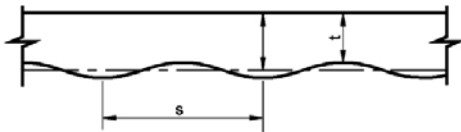
$s$  = Spacing of ribs or undulations.

$t$  = Minimum thickness.

$t_e$  = Equivalent thickness of the slab calculated as the net area of the slab divided by the width, in which the maximum thickness used in the calculation shall not exceed  $2t$ .



NEGLECT SHADED AREA IN CALCULATION OF EQUIVALENT THICKNESS

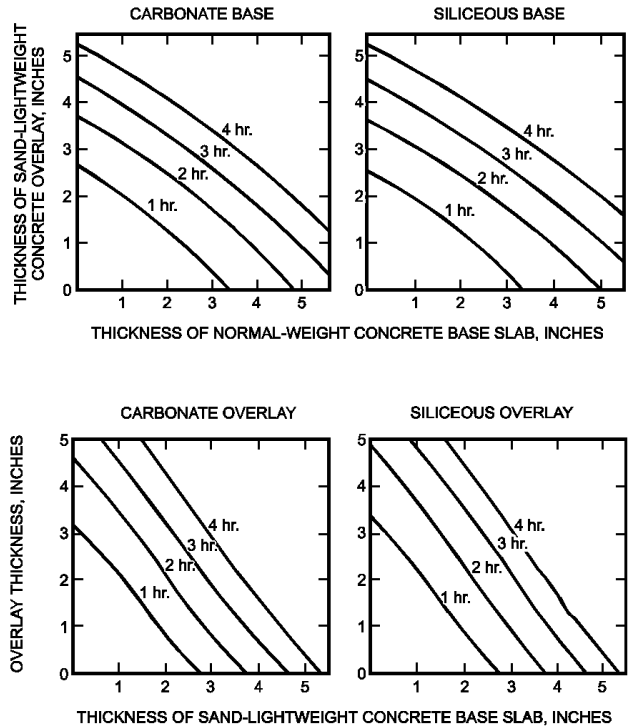


For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.2.1.3  
SLABS WITH RIBBED OR UNDULATING SOFFITS**

**722.2.2.2 Multicourse floors.** The fire-resistance ratings of floors that consist of a base slab of concrete with a topping (overlay) of a different type of concrete shall comply with Figure 722.2.2.2.

**722.2.2.3 Multicourse roofs.** The fire-resistance ratings of roofs which consist of a base slab of concrete with a topping (overlay) of an insulating concrete or with an insulating board and built-up roofing shall comply with Figures 722.2.2.3(1) and 722.2.2.3(2).



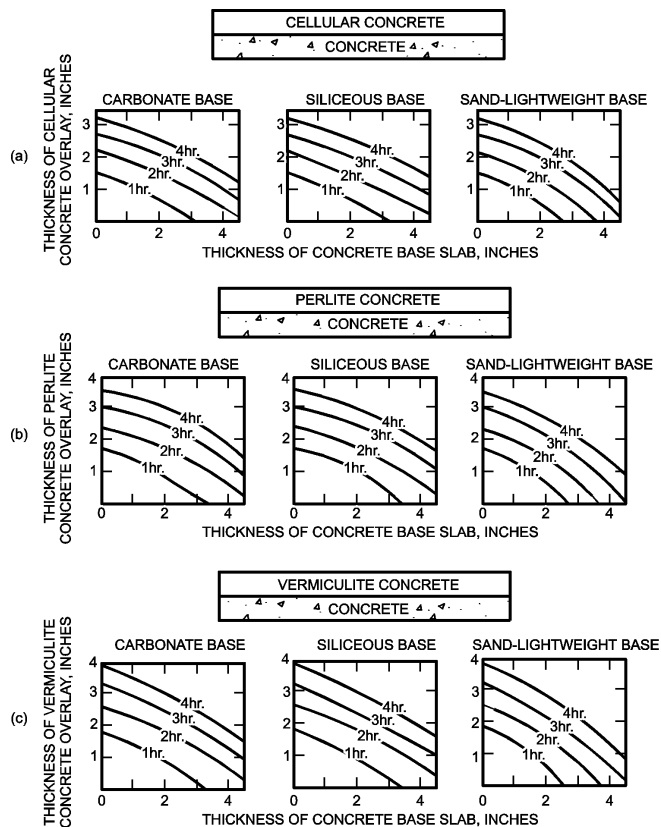
For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.2  
FIRE-RESISTANCE RATINGS FOR  
TWO-COURSE CONCRETE FLOORS**

**722.2.2.3.1 Heat transfer.** For the transfer of heat, three-ply built-up roofing contributes 10 minutes to the fire-resistance rating. The fire-resistance rating for concrete assemblies such as those shown in Figure 722.2.2.3(1) shall be increased by 10 minutes. This increase is not applicable to those shown in Figure 722.2.2.3(2).

**722.2.2.4 Joints in precast slabs.** Joints between adjacent precast concrete slabs need not be considered in calculating the slab thickness provided that a concrete topping at least 1 inch (25 mm) thick is used. Where no concrete topping is used, joints must be grouted to a depth of at least one-third the slab thickness at the joint, but not less than 1 inch (25 mm), or the joints must be made fire resistant by other approved methods.

**722.2.3 Concrete cover over reinforcement.** The minimum thickness of concrete cover over reinforcement in concrete slabs, reinforced beams and prestressed beams shall comply with this section.



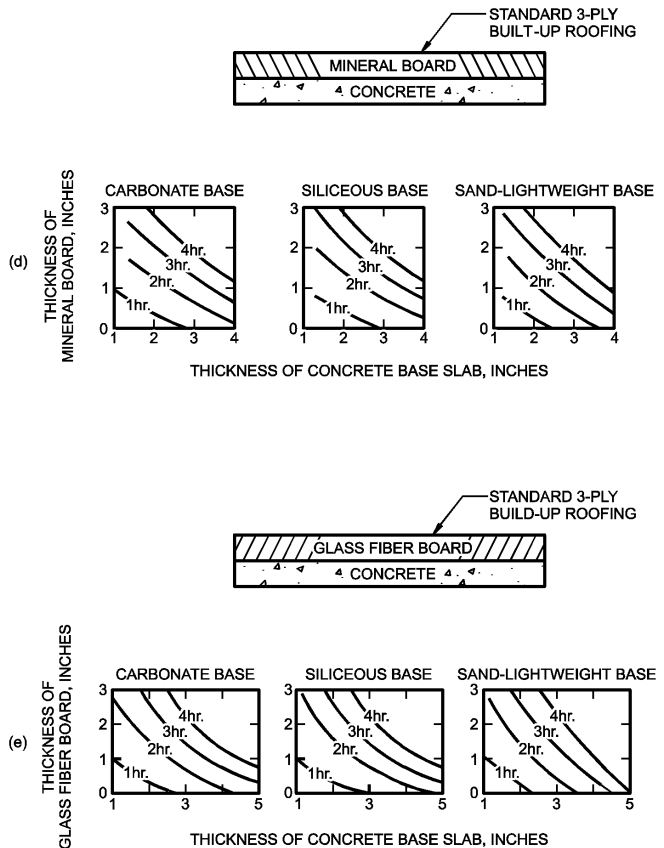
For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.3(1)**  
**FIRE-RESISTANCE RATINGS FOR**  
**CONCRETE ROOF ASSEMBLIES**

**722.2.3.1 Slab cover.** The minimum thickness of concrete cover to the positive moment reinforcement shall comply with Table 722.2.3(1) for reinforced concrete and Table 722.2.3(2) for prestressed concrete. These tables are applicable for solid or hollow-core one-way or two-way slabs with flat undersurfaces. These tables are applicable to slabs that are either cast in place or precast. For precast prestressed concrete not covered elsewhere, the procedures contained in PCI MNL 124 shall be acceptable.

**722.2.3.2 Reinforced beam cover.** The minimum thickness of concrete cover to the positive moment reinforcement (bottom steel) for reinforced concrete beams is shown in Table 722.2.3(3) for fire-resistance ratings of 1 hour to 4 hours.

**722.2.3.3 Prestressed beam cover.** The minimum thickness of concrete cover to the positive moment prestressing tendons (bottom steel) for restrained and unrestrained prestressed concrete beams and stemmed units shall comply with the values shown in Tables 722.2.3(4) and 722.2.3(5) for fire-resistance ratings of 1 hour to 4 hours. Values in Table 722.2.3(4) apply to beams 8 inches (203 mm) or greater in width. Values in Table 722.2.3(5) apply to beams or stems of any width, provided the cross-section area is not less than 40 square inches (25 806 mm<sup>2</sup>). In case of differences



For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.3(2)**  
**FIRE-RESISTANCE RATINGS**  
**FOR CONCRETE ROOF ASSEMBLIES**

between the values determined from Table 722.2.3(4) or 722.2.3(5), it is permitted to use the smaller value. The concrete cover shall be calculated in accordance with Section 722.2.3.3.1. The minimum concrete cover for nonprestressed reinforcement in prestressed concrete beams shall comply with Section 722.2.3.2.

**722.2.3.3.1 Calculating concrete cover.** The concrete cover for an individual tendon is the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the beam, except that for ungrouted ducts, the assumed cover thickness is the minimum thickness of concrete between the surface of the duct and the fire-exposed surface of the beam. For beams in which two or more tendons are used, the cover is assumed to be the average of the minimum cover of the individual tendons. For corner tendons (tendons equal distance from the bottom and side), the minimum cover used in the calculation shall be one-half the actual value. For stemmed members with two or more prestressing tendons located along the vertical centerline of the stem, the average cover shall be the distance from the bottom of the member to the centroid of the tendons. The actual cover for any individual tendon shall not be less than one-half the smaller value shown in Tables 722.2.3(4) and 722.2.3(5), or 1 inch (25 mm), whichever is greater.

**TABLE 722.2.3(1)**  
**COVER THICKNESS FOR REINFORCED CONCRETE FLOOR OR ROOF SLABS (inches)**

CONCRETE AGGREGATE TYPE	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
	1	1½	2	3	4	1	1½	2	3	4
Siliceous	¾	¾	¾	¾	¾	¾	¾	1	1¼	1⅝
Carbonate	¾	¾	¾	¾	¾	¾	¾	¾	1¼	1¼
Sand-lightweight or lightweight	¾	¾	¾	¾	¾	¾	¾	¾	1¼	1¼

For SI: 1 inch = 25.4 mm.

**TABLE 722.2.3(2)**  
**COVER THICKNESS FOR PRESTRESSED CONCRETE FLOOR OR ROOF SLABS (inches)**

CONCRETE AGGREGATE TYPE	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
	1	1½	2	3	4	1	1½	2	3	4
Siliceous	¾	¾	¾	¾	¾	1⅛	1½	1¾	2¾	2¾
Carbonate	¾	¾	¾	¾	¾	1	1⅜	1⅝	2⅛	2¼
Sand-lightweight or lightweight	¾	¾	¾	¾	¾	1	1⅜	1½	2	2¼

For SI: 1 inch = 25.4 mm.

**TABLE 722.2.3(3)**  
**MINIMUM COVER FOR MAIN REINFORCING BARS OF REINFORCED CONCRETE BEAMS<sup>c</sup>**  
**(APPLICABLE TO ALL TYPES OF STRUCTURAL CONCRETE)**

RESTRAINED OR UNRESTRAINED <sup>a</sup>	BEAM WIDTH <sup>b</sup> (inches)	FIRE-RESISTANCE RATING (hours)				
		1	1½	2	3	4
Restrained	5	¾	¾	¾	1 <sup>a</sup>	1¼ <sup>a</sup>
	7	¾	¾	¾	¾	¾
	≥ 10	¾	¾	¾	¾	¾
Unrestrained	5	¾	1	1¼	—	—
	7	¾	¾	¾	1¾	3
	≥ 10	¾	¾	¾	1	1¾

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for ratings of 4 hours or less.
- b. For beam widths between the tabulated values, the minimum cover thickness can be determined by direct interpolation.
- c. The cover for an individual reinforcing bar is the minimum thickness of concrete between the surface of the bar and the fire-exposed surface of the beam. For beams in which several bars are used, the cover for corner bars used in the calculation shall be reduced to one-half of the actual value. The cover for an individual bar must be not less than one-half of the value given in Table 722.2.3(3) nor less than ¾ inch.

**TABLE 722.2.3(4)**  
**MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS 8 INCHES OR GREATER IN WIDTH<sup>b</sup>**

RESTRAINED OR UNRESTRAINED <sup>a</sup>	CONCRETE AGGREGATE TYPE	BEAM WIDTH (inches)	FIRE-RESISTANCE RATING (hours)				
			1	1½	2	3	4
Restrained	Carbonate or siliceous	8	1½	1½	1½	1¾ <sup>a</sup>	2½ <sup>a</sup>
	Carbonate or siliceous	≥ 12	1½	1½	1½	1½	1⅞ <sup>a</sup>
	Sand lightweight	8	1½	1½	1½	1½	2 <sup>a</sup>
	Sand lightweight	≥ 12	1½	1½	1½	1½	1⅝ <sup>a</sup>
Unrestrained	Carbonate or siliceous	8	1½	1¾	2½	5 <sup>c</sup>	—
	Carbonate or siliceous	≥ 12	1½	1½	1⅞ <sup>a</sup>	2½	3
	Sand lightweight	8	1½	1½	2	3¼	—
	Sand lightweight	≥ 12	1½	1½	1⅝	2	2½

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for 4-hour ratings or less.
- b. For beam widths between 8 inches and 12 inches, minimum cover thickness can be determined by direct interpolation.
- c. Not practical for 8-inch-wide beam but shown for purposes of interpolation.

**TABLE 722.2.3(5)**  
**MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS OF ALL WIDTHS**

RESTRAINED OR UNRESTRAINED <sup>a</sup>	CONCRETE AGGREGATE TYPE	BEAM AREA <sup>b</sup> A (square inches)	FIRE-RESISTANCE RATING (hours)				
			1	1½	2	3	4
Restrained	All	40 ≤ A ≤ 150	1½	1½	2	2½	—
	Carbonate or siliceous	150 < A ≤ 300	1½	1½	1½	1¾	2½
		300 < A	1½	1½	1½	1½	2
	Sand lightweight	150 < A	1½	1½	1½	1½	2
Unrestrained	All	40 ≤ A ≤ 150	2	2½	—	—	—
	Carbonate or siliceous	150 < A ≤ 300	1½	1¾	2½	—	—
		300 < A	1½	1½	2	3 <sup>c</sup>	4 <sup>c</sup>
	Sand lightweight	150 < A	1½	1½	2	3 <sup>c</sup>	4 <sup>c</sup>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for 4-hour ratings or less.
- The cross-sectional area of a stem is permitted to include a portion of the area in the flange, provided the width of the flange used in the calculation does not exceed three times the average width of the stem.
- U-shaped or hooped stirrups spaced not to exceed the depth of the member and having a minimum cover of 1 inch shall be provided.

**722.2.4 Concrete columns.** Concrete columns shall comply with this section.

**TABLE 722.2.4**  
**MINIMUM DIMENSION OF CONCRETE COLUMNS (inches)**

TYPES OF CONCRETE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2 <sup>a</sup>	3 <sup>a</sup>	4 <sup>b</sup>
Siliceous	8	9	10	12	14
Carbonate	8	9	10	11	12
Sand-lightweight	8	8½	9	10½	12

For SI: 1 inch = 25 mm.

- The minimum dimension is permitted to be reduced to 8 inches for rectangular columns with two parallel sides at least 36 inches in length.
- The minimum dimension is permitted to be reduced to 10 inches for rectangular columns with two parallel sides at least 36 inches in length.

**722.2.4.1 Minimum size.** The minimum overall dimensions of reinforced concrete columns for fire-resistance ratings of 1 hour to 4 hours for exposure to fire on all sides shall comply with this section.

**722.2.4.1.1 Concrete strength less than or equal to 12,000 psi.** For columns made with concrete having a specified compressive strength,  $f'_c$ , of less than or equal to 12,000 psi (82.7 MPa), the minimum dimension shall comply with Table 722.2.4.

**722.2.4.1.2 Concrete strength greater than 12,000 psi.** For columns made with concrete having a specified compressive strength,  $f'_c$ , greater than 12,000 psi (82.7 MPa), for fire-resistance ratings of 1 hour to 4 hours the minimum dimension shall be 24 inches (610 mm).

**722.2.4.2 Minimum cover for R/C columns.** The minimum thickness of concrete cover to the main longitudinal reinforcement in columns, regardless of the type of aggregate used in the concrete and the specified compressive strength of concrete,  $f'_c$ , shall not be less

than 1 inch (25 mm) times the number of hours of required fire resistance or 2 inches (51 mm), whichever is less.

**722.2.4.3 Tie and spiral reinforcement.** For concrete columns made with concrete having a specified compressive strength,  $f'_c$ , greater than 12,000 psi (82.7 MPa), tie and spiral reinforcement shall comply with the following:

- The free ends of rectangular ties shall terminate with a 135-degree (2.4 rad) standard tie hook.
- The free ends of circular ties shall terminate with a 90-degree (1.6 rad) standard tie hook.
- The free ends of spirals, including at lap splices, shall terminate with a 90-degree (1.6 rad) standard tie hook.

The hook extension at the free end of ties and spirals shall be the larger of six bar diameters and the extension required by Section 7.1.3 of ACI 318. Hooks shall project into the core of the column.

**722.2.4.4 Columns built into walls.** The minimum dimensions of Table 722.2.4 do not apply to a reinforced concrete column that is built into a concrete or masonry wall provided all of the following are met:

- The fire-resistance rating for the wall is equal to or greater than the required rating of the column;
- The main longitudinal reinforcing in the column has cover not less than that required by Section 722.2.4.2; and
- Openings in the wall are protected in accordance with Table 716.5.

Where openings in the wall are not protected as required by Section 716.5, the minimum dimension of columns required to have a fire-resistance rating of 3 hours or less shall be 8 inches (203 mm), and 10 inches (254 mm) for columns required to have a fire-resistance

rating of 4 hours, regardless of the type of aggregate used in the concrete.

**722.2.4.5 Precast cover units for steel columns.** See Section 722.5.1.4.

**722.3 Concrete masonry.** The provisions of this section contain procedures by which the fire-resistance ratings of concrete masonry are established by calculations.

**722.3.1 Equivalent thickness.** The equivalent thickness of concrete masonry construction shall be determined in accordance with the provisions of this section.

**722.3.1.1 Concrete masonry unit plus finishes.** The equivalent thickness of concrete masonry assemblies,  $T_{ea}$ , shall be computed as the sum of the equivalent thickness of the concrete masonry unit,  $T_e$ , as determined by Section 722.3.1.2, 722.3.1.3 or 722.3.1.4, plus the equivalent thickness of finishes,  $T_{ef}$ , determined in accordance with Section 722.3.2:

$$T_{ea} = T_e + T_{ef} \quad (\text{Equation 7-6})$$

**722.3.1.2 UngROUTED or partially grouted construction.**  $T_e$  shall be the value obtained for the concrete masonry unit determined in accordance with ASTM C 140.

**722.3.1.3 Solid grouted construction.** The equivalent thickness,  $T_e$ , of solid grouted concrete masonry units is the actual thickness of the unit.

**722.3.1.4 Airspaces and cells filled with loose-fill material.** The equivalent thickness of completely filled hollow concrete masonry is the actual thickness of the unit when loose-fill materials are: sand, pea gravel, crushed stone, or slag that meet ASTM C 33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders that comply with ASTM C 331; or perlite or vermiculite meeting the requirements of ASTM C 549 and ASTM C 516, respectively.

**722.3.2 Concrete masonry walls.** The fire-resistance rating of walls and partitions constructed of concrete masonry units shall be determined from Table 722.3.2. The rating shall be based on the equivalent thickness of the masonry and type of aggregate used.

**722.3.2.1 Finish on nonfire-exposed side.** Where plaster or gypsum wallboard is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of gypsum wallboard or plaster shall be corrected by multiplying the actual thickness of the finish by applicable factor determined from Table 722.2.1.4(1). This corrected thickness of finish shall be added to the equivalent thickness of masonry and the fire-resistance rating of the masonry and finish determined from Table 722.3.2.

**722.3.2.2 Finish on fire-exposed side.** Where plaster or gypsum wallboard is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 722.2.1.4(2) shall be added to the fire-resistance rating determined in Section 722.3.2 for the masonry alone, or in Section 722.3.2.1 for the masonry and finish on the nonfire-exposed side.

**722.3.2.3 Nonsymmetrical assemblies.** For a wall having no finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of this section shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-resistance rating of the wall shall not exceed the lower of the two values calculated.

**Exception:** For exterior walls with a fire separation distance greater than 5 feet (1524 mm) the fire shall be assumed to occur on the interior side only.

**722.3.2.4 Minimum concrete masonry fire-resistance rating.** Where the finish applied to a concrete masonry wall contributes to its fire-resistance rating, the masonry alone shall provide not less than one-half the total required fire-resistance rating.

**722.3.2.5 Attachment of finishes.** Installation of finishes shall be as follows:

1. Gypsum wallboard and gypsum lath applied to concrete masonry or concrete walls shall be secured to wood or steel furring members spaced not more than 16 inches (406 mm) on center (o.c.).

**TABLE 722.3.2**  
**MINIMUM EQUIVALENT THICKNESS (inches) OF BEARING OR NONBEARING CONCRETE MASONRY WALLS<sup>a,b,c,d</sup>**

TYPE OF AGGREGATE	FIRE-RESISTANCE RATING (hours)														
	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.0	5.2	5.5	5.7	5.9
Calcareous or siliceous gravel	2.0	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.2

For SI: 1 inch = 25.4 mm.

- a. Values between those shown in the table can be determined by direct interpolation.
- b. Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall not be less than 93 percent of the thickness shown in the table.
- c. Requirements of ASTM C 55, ASTM C 73, ASTM C 90 or ASTM C 744 shall apply.
- d. Minimum required equivalent thickness corresponding to the hourly fire-resistance rating for units with a combination of aggregate shall be determined by linear interpolation based on the percent by volume of each aggregate used in manufacture.

## FIRE AND SMOKE PROTECTION FEATURES

- Gypsum wallboard shall be installed with the long dimension parallel to the furring members and shall have all joints finished.
- Other aspects of the installation of finishes shall comply with the applicable provisions of Chapters 7 and 25.

**722.3.3 Multiwythe masonry walls.** The fire-resistance rating of wall assemblies constructed of multiple wythes of masonry materials shall be permitted to be based on the fire-resistance rating period of each wythe and the continuous airspace between each wythe in accordance with the following formula:

$$R_A = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59} + A_1 + A_2 + \dots + A_n)^{1.7} \quad (\text{Equation 7-7})$$

where:

$R_A$  = Fire-resistance rating of the assembly (hours).

$R_1, R_2, \dots, R_n$  = Fire-resistance rating of wythes for 1, 2,  $n$  (hours), respectively.

$A_1, A_2, \dots, A_n$  = 0.30, factor for each continuous airspace for 1, 2,  $\dots, n$ , respectively, having a depth of  $\frac{1}{2}$  inch (12.7 mm) or more between wythes.

**722.3.4 Concrete masonry lintels.** Fire-resistance ratings for concrete masonry lintels shall be determined based upon the nominal thickness of the lintel and the minimum thickness of concrete masonry or concrete, or any combination thereof, covering the main reinforcing bars, as determined according to Table 722.3.4, or by approved alternate methods.

**TABLE 722.3.4**  
**MINIMUM COVER OF LONGITUDINAL REINFORCEMENT IN**  
**FIRE-RESISTANCE-RATED REINFORCED CONCRETE**  
**MASONRY LINTELS (inches)**

NOMINAL WIDTH OF LINTEL (inches)	FIRE-RESISTANCE RATING (hours)			
	1	2	3	4
6	1½	2	—	—
8	1½	1½	1¾	3
10 or greater	1½	1½	1½	1¾

For SI: 1 inch = 25.4 mm.

**TABLE 722.4.1(1)**  
**FIRE-RESISTANCE PERIODS OF CLAY MASONRY WALLS**

MATERIAL TYPE	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE RESISTANCE <sup>a, b, c</sup> (inches)			
	1 hour	2 hours	3 hours	4 hours
Solid brick of clay or shale <sup>d</sup>	2.7	3.8	4.9	6.0
Hollow brick or tile of clay or shale, unfilled	2.3	3.4	4.3	5.0
Hollow brick or tile of clay or shale, grouted or filled with materials specified in Section 722.4.1.1.3	3.0	4.4	5.5	6.6

For SI: 1 inch = 25.4 mm.

- Equivalent thickness as determined from Section 722.4.1.1.
- Calculated fire resistance between the hourly increments listed shall be determined by linear interpolation.
- Where combustible members are framed in the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall not be less than 93 percent of the thickness shown.
- For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is at least 75 percent of the gross cross-sectional area measured in the same plane.

**722.3.5 Concrete masonry columns.** The fire-resistance rating of concrete masonry columns shall be determined based upon the least plan dimension of the column in accordance with Table 722.3.5 or by approved alternate methods.

**TABLE 722.3.5**  
**MINIMUM DIMENSION OF CONCRETE**  
**MASONRY COLUMNS (inches)**

FIRE-RESISTANCE RATING (hours)			
1	2	3	4
8 inches	10 inches	12 inches	14 inches

For SI: 1 inch = 25.4 mm.

**722.4 Clay brick and tile masonry.** The provisions of this section contain procedures by which the fire-resistance ratings of clay brick and tile masonry are established by calculations.

**722.4.1 Masonry walls.** The fire-resistance rating of masonry walls shall be based upon the equivalent thickness as calculated in accordance with this section. The calculation shall take into account finishes applied to the wall and airspaces between wythes in multiwythe construction.

**722.4.1.1 Equivalent thickness.** The fire-resistance ratings of walls or partitions constructed of solid or hollow clay masonry units shall be determined from Table 722.4.1(1) or 722.4.1(2). The equivalent thickness of the clay masonry unit shall be determined by Equation 7-8 when using Table 722.4.1(1). The fire-resistance rating determined from Table 722.4.1(1) shall be permitted to be used in the calculated fire-resistance rating procedure in Section 722.4.2.

$$T_e = V_n / LH \quad (\text{Equation 7-8})$$

where:

$T_e$  = The equivalent thickness of the clay masonry unit (inches).

$V_n$  = The net volume of the clay masonry unit (inch<sup>3</sup>).

$L$  = The specified length of the clay masonry unit (inches).

$H$  = The specified height of the clay masonry unit (inches).



**TABLE 722.4.1(2)**  
**FIRE-RESISTANCE RATINGS FOR BEARING STEEL FRAME BRICK VENEER WALLS OR PARTITIONS**

WALL OR PARTITION ASSEMBLY	PLASTER SIDE EXPOSED (hours)	BRICK FACED SIDE EXPOSED (hours)
Outside facing of steel studs: $\frac{1}{2}$ " wood fiberboard sheathing next to studs, $\frac{3}{4}$ " airspace formed with $\frac{3}{4}$ " $\times$ $1\frac{5}{8}$ " wood strips placed over the fiberboard and secured to the studs; metal or wire lath nailed to such strips, $\frac{3}{4}$ " brick veneer held in place by filling $\frac{3}{4}$ " airspace between the brick and lath with mortar. Inside facing of studs: $\frac{3}{4}$ " unsanded gypsum plaster on metal or wire lath attached to $\frac{5}{16}$ " wood strips secured to edges of the studs.	1.5	4
Outside facing of steel studs: 1" insulation board sheathing attached to studs, 1" airspace, and $\frac{3}{4}$ " brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: $\frac{7}{8}$ " sanded gypsum plaster (1:2 mix) applied on metal or wire lath attached directly to the studs.	1.5	4
Same as above except use $\frac{7}{8}$ " vermiculite-gypsum plaster or 1" sanded gypsum plaster (1:2 mix) applied to metal or wire.	2	4
Outside facing of steel studs: $\frac{1}{2}$ " gypsum sheathing board, attached to studs, and $\frac{3}{4}$ " brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: $\frac{1}{2}$ " sanded gypsum plaster (1:2 mix) applied to $\frac{1}{2}$ " perforated gypsum lath securely attached to studs and having strips of metal lath 3 inches wide applied to all horizontal joints of gypsum lath.	2	4

For SI: 1 inch = 25.4 mm.

**722.4.1.1.1 Hollow clay units.** The equivalent thickness,  $T_e$ , shall be the value obtained for hollow clay units as determined in accordance with Equation 7-8. The net volume,  $V_n$ , of the units shall be determined using the gross volume and percentage of void area determined in accordance with ASTM C 67.

**722.4.1.1.2 Solid grouted clay units.** The equivalent thickness of solid grouted clay masonry units shall be taken as the actual thickness of the units.

**722.4.1.1.3 Units with filled cores.** The equivalent thickness of the hollow clay masonry units is the actual thickness of the unit when completely filled with loose-fill materials of: sand, pea gravel, crushed stone, or slag that meet ASTM C 33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders in compliance with ASTM C 331; or perlite or vermiculite meeting the requirements of ASTM C 549 and ASTM C 516, respectively.

**722.4.1.2 Plaster finishes.** Where plaster is applied to the wall, the total fire-resistance rating shall be determined by the formula:

$$R = (R_n^{0.59} + pl)^{1.7} \quad \text{(Equation 7-9)}$$

where:

$R$  = The fire-resistance rating of the assembly (hours).

$R_n$  = The fire-resistance rating of the individual wall (hours).

$pl$  = Coefficient for thickness of plaster.

Values for  $R_n^{0.59}$  for use in Equation 7-9 are given in Table 722.4.1(3). Coefficients for thickness of plaster shall be selected from Table 722.4.1(4) based on the

actual thickness of plaster applied to the wall or partition and whether one or two sides of the wall are plastered.

**TABLE 722.4.1(3)**  
**VALUES OF  $R_n^{0.59}$**

$R_n^{0.59}$	$R$ (hours)
1	1.0
2	1.50
3	1.91
4	2.27

**TABLE 722.4.1(4)**  
**COEFFICIENTS FOR PLASTER,  $pl^a$**

THICKNESS OF PLASTER (inch)	ONE SIDE	TWO SIDES
$\frac{1}{2}$	0.3	0.6
$\frac{5}{8}$	0.37	0.75
$\frac{3}{4}$	0.45	0.90

For SI: 1 inch = 25.4 mm.

a. Values listed in table are for 1:3 sanded gypsum plaster.

**TABLE 722.4.1(5)**  
**REINFORCED MASONRY LINTELS**

NOMINAL LINTEL WIDTH (inches)	MINIMUM LONGITUDINAL REINFORCEMENT COVER FOR FIRE RESISTANCE (inches)			
	1 hour	2 hours	3 hours	4 hours
6	$1\frac{1}{2}$	2	NP	NP
8	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	3
10 or more	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$

For SI: 1 inch = 25.4 mm.

NP = Not permitted.

**TABLE 722.4.1(6)**  
**REINFORCED CLAY MASONRY COLUMNS**

COLUMN SIZE	FIRE-RESISTANCE RATING (hours)			
	1	2	3	4
Minimum column dimension (inches)	8	10	12	14

For SI: 1 inch = 25.4 mm.

**722.4.1.3 Multiwythe walls with airspace.** Where a continuous airspace separates multiple wythes of the wall or partition, the total fire-resistance rating shall be determined by the formula:

$$R = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59} + as)^{1.7} \quad \text{(Equation 7-10)}$$

where:

$R$  = The fire-resistance rating of the assembly (hours).

$R_1, R_2$  and  $R_n$  = The fire-resistance rating of the individual wythes (hours).

$as$  = Coefficient for continuous airspace.

Values for  $R_n^{0.59}$  for use in Equation 7-10 are given in Table 722.4.1(3). The coefficient for each continuous airspace of  $1/2$  inch to  $3 1/2$  inches (12.7 to 89 mm) separating two individual wythes shall be 0.3.

**722.4.1.4 Nonsymmetrical assemblies.** For a wall having no finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of this section shall be performed twice, assuming either side to be the fire-exposed side of the wall. The fire resistance of the wall shall not exceed the lower of the two values determined.

**Exception:** For exterior walls with a fire separation distance greater than 5 feet (1524 mm), the fire shall be assumed to occur on the interior side only.

**722.4.2 Multiwythe walls.** The fire-resistance rating for walls or partitions consisting of two or more dissimilar wythes shall be permitted to be determined by the formula:

$$R = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59})^{1.7} \quad \text{(Equation 7-11)}$$

where:

$R$  = The fire-resistance rating of the assembly (hours).

$R_1, R_2$  and  $R_n$  = The fire-resistance rating of the individual wythes (hours).

Values for  $R_n^{0.59}$  for use in Equation 7-11 are given in Table 722.4.1(3).

**722.4.2.1 Multiwythe walls of different material.** For walls that consist of two or more wythes of different materials (concrete or concrete masonry units) in combination with clay masonry units, the fire-resistance rating of the different materials shall be permitted to be determined from Table 722.2.1.1 for concrete; Table 722.3.2 for concrete masonry units or Table 722.4.1(1) or 722.4.1(2) for clay and tile masonry units.

**722.4.3 Reinforced clay masonry lintels.** Fire-resistance ratings for clay masonry lintels shall be determined based on the nominal width of the lintel and the minimum covering for the longitudinal reinforcement in accordance with Table 722.4.1(5).

**722.4.4 Reinforced clay masonry columns.** The fire-resistance ratings shall be determined based on the last plan dimension of the column in accordance with Table 722.4.1(6). The minimum cover for longitudinal reinforcement shall be 2 inches (51 mm).

**722.5 Steel assemblies.** The provisions of this section contain procedures by which the fire-resistance ratings of steel assemblies are established by calculations.

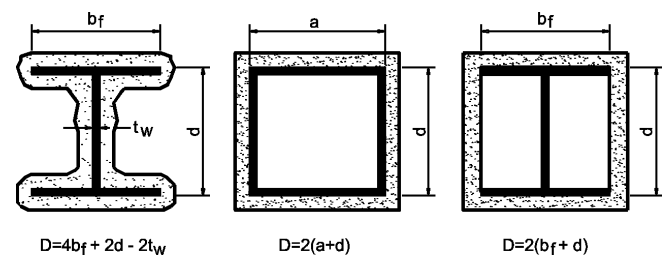
**722.5.1 Structural steel columns.** The fire-resistance ratings of steel columns shall be based on the size of the element and the type of protection provided in accordance with this section.

**722.5.1.1 General.** These procedures establish a basis for determining the fire resistance of column assemblies as a function of the thickness of fire-resistant material and, the weight,  $W$ , and heated perimeter,  $D$ , of steel columns. As used in these sections,  $W$  is the average weight of a structural steel column in pounds per linear foot. The heated perimeter,  $D$ , is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 722.5.1(1).

**722.5.1.1.1 Nonload-bearing protection.** The application of these procedures shall be limited to column assemblies in which the fire-resistant material is not designed to carry any of the load acting on the column.

**722.5.1.1.2 Embedments.** In the absence of substantiating fire-endurance test results, ducts, conduit, piping, and similar mechanical, electrical, and plumbing installations shall not be embedded in any required fire-resistant materials.

**722.5.1.1.3 Weight-to-perimeter ratio.** Table 722.5.1(1) contains weight-to-heated-perimeter ratios ( $W/D$ ) for both contour and box fire-resistant profiles, for the wide flange shapes most often used as columns. For different fire-resistant protection profiles or column cross sections, the weight-to-



**FIGURE 722.5.1(1)**  
**DETERMINATION OF THE HEATED PERIMETER OF**  
**STRUCTURAL STEEL COLUMNS**

heated-perimeter ratios ( $W/D$ ) shall be determined in accordance with the definitions given in this section.

**722.5.1.2 Gypsum wallboard protection.** The fire resistance of structural steel columns with weight-to-heated-perimeter ratios ( $W/D$ ) less than or equal to 3.65 and which are protected with Type X gypsum wallboard shall be permitted to be determined from the following expression:

$$R = 130 \left[ \frac{h(W/D)^{0.75}}{2} \right] \quad (\text{Equation 7-12})$$

where:

$R$  = Fire resistance (minutes).

$h$  = Total thickness of gypsum wallboard (inches).

$D$  = Heated perimeter of the structural steel column (inches).

$W'$  = Total weight of the structural steel column and gypsum wallboard protection (pounds per linear foot).

$W' = W + 50hD/144$ .

**722.5.1.2.1 Attachment.** The gypsum wallboard shall be supported as illustrated in either Figure 722.5.1(2) for fire-resistance ratings of 4 hours or less, or Figure 722.5.1(3) for fire-resistance ratings of 3 hours or less.

**722.5.1.2.2 Gypsum wallboard equivalent to concrete.** The determination of the fire resistance of structural steel columns from Figure 722.5.1(4) is permitted for various thicknesses of gypsum wallboard as a function of the weight-to-heated-perimeter ratio ( $W/D$ ) of the column. For structural steel columns with weight-to-heated-perimeter ratios ( $W/D$ ) greater than 3.65, the thickness of gypsum wallboard required for specified fire-resistance ratings shall be the same as the thickness determined for a  $W14 \times 233$  wide flange shape.

**722.5.1.3 Sprayed fire-resistant materials.** The fire resistance of wide-flange structural steel columns protected with sprayed fire-resistant materials, as illustrated in Figure 722.5.1(5), shall be permitted to be determined from the following expression:

$$R = [C_1(W/D) + C_2]h \quad (\text{Equation 7-13})$$

where:

$R$  = Fire resistance (minutes).

$h$  = Thickness of sprayed fire-resistant material (inches).

$D$  = Heated perimeter of the structural steel column (inches).

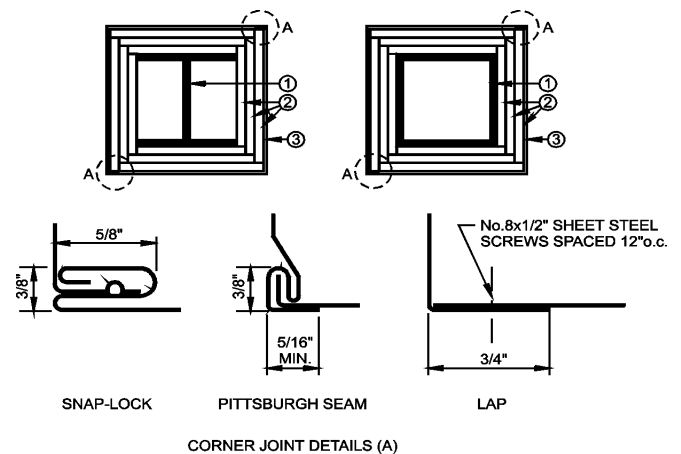
$C_1$  and  $C_2$  = Material-dependent constants.

$W$  = Weight of structural steel columns (pounds per linear foot).

The fire resistance of structural steel columns protected with intumescent or mastic fire-resistant coatings

shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

**722.5.1.3.1 Material-dependent constants.** The material-dependent constants,  $C_1$  and  $C_2$ , shall be determined for specific fire-resistant materials on the basis of standard fire endurance tests in accordance with Section 703.2. Unless evidence is submitted to the building official substantiating a broader application, this expression shall be limited to determining the fire resistance of structural steel columns with weight-to-heated-perimeter ratios ( $W/D$ ) between the largest and smallest columns for which standard fire-resistance test results are available.



**FIGURE 722.5.1(2)**  
**GYPSON WALLBOARD PROTECTED STRUCTURAL STEEL COLUMNS WITH SHEET STEEL COLUMN COVERS**

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. Type X gypsum wallboard in accordance with ASTM C 1396. For single-layer applications, the wallboard shall be applied vertically with no horizontal joints. For multiple-layer applications, horizontal joints are permitted at a minimum spacing of 8 feet, provided that the joints in successive layers are staggered at least 12 inches. The total required thickness of wallboard shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio ( $W/D$ ) of the column. For fire-resistance ratings of 2 hours or less, one of the required layers of gypsum wallboard may be applied to the exterior of the sheet steel column covers with 1-inch long Type S screws spaced 1 inch from the wallboard edge and 8 inches on center. For such installations, 0.0149-inch minimum thickness galvanized steel corner beads with 1 1/2-inch legs shall be attached to the wallboard with Type S screws spaced 12 inches on center.
3. For fire-resistance ratings of 3 hours or less, the column covers shall be fabricated from 0.0239-inch minimum thickness galvanized or stainless steel. For 4-hour fire-resistance ratings, the column covers shall be fabricated from 0.0239-inch minimum thickness stainless steel. The column covers shall be erected with the Snap Lock or Pittsburgh joint details. For fire-resistance ratings of 2 hours or less, column covers fabricated from 0.0269-inch minimum thickness galvanized or stainless steel shall be permitted to be erected with lap joints. The lap joints shall be permitted to be located anywhere around the perimeter of the column cover. The lap joints shall be secured with 1/2-inch-long No. 8 sheet metal screws spaced 12 inches on center. The column covers shall be provided with a minimum expansion clearance of 1/8 inch per linear foot between the ends of the cover and any restraining construction.

## FIRE AND SMOKE PROTECTION FEATURES

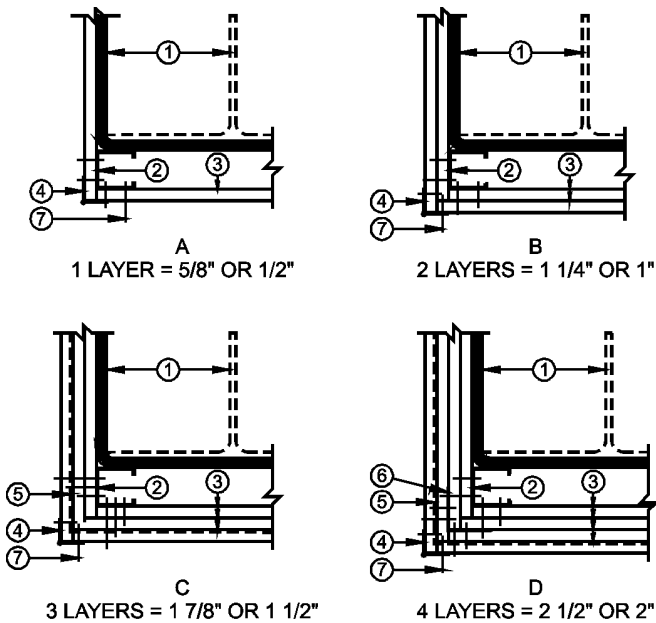


FIGURE 722.5.1(3)

### GYPSUM WALLBOARD PROTECTED STRUCTURAL STEEL COLUMNS WITH STEEL STUD/SCREW ATTACHMENT SYSTEM

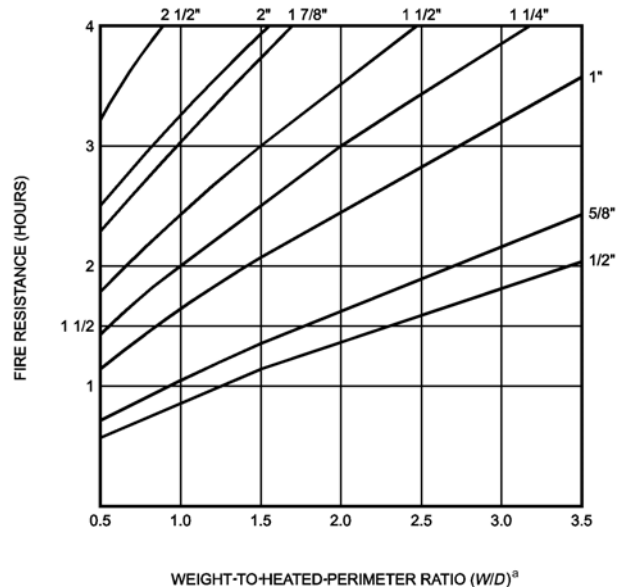
For SI: 1 inch = 25.4 mm, 1 foot = -305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2.  $1\frac{5}{8}$ -inch deep studs fabricated from 0.0179-inch minimum thickness galvanized steel with  $1\frac{3}{16}$  or  $1\frac{7}{16}$ -inch legs. The length of the steel studs shall be  $\frac{1}{2}$  inch less than the height of the assembly.
3. Type X gypsum wallboard in accordance with ASTM C 1396. For single-layer applications, the wallboard shall be applied vertically with no horizontal joints. For multiple-layer applications, horizontal joints are permitted at a minimum spacing of 8 feet, provided that the joints in successive layers are staggered at least 12 inches. The total required thickness of wallboard shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (W/D) of the column.
4. Galvanized 0.0149-inch minimum thickness steel corner beads with  $1\frac{1}{2}$ -inch legs attached to the wallboard with 1-inch-long Type S screws spaced 12 inches on center.
5. No. 18 SWG steel tie wires spaced 24 inches on center.
6. Sheet metal angles with 2-inch legs fabricated from 0.0221-inch minimum thickness galvanized steel.
7. Type S screws, 1 inch long, shall be used for attaching the first layer of wallboard to the steel studs and the third layer to the sheet metal angles at 24 inches on center. Type S screws  $1\frac{3}{4}$ -inch long shall be used for attaching the second layer of wallboard to the steel studs and the fourth layer to the sheet metal angles at 12 inches on center. Type S screws  $2\frac{1}{4}$  inches long shall be used for attaching the third layer of wallboard to the steel studs at 12 inches on center.

**722.5.1.3.2 Identification.** Sprayed fire-resistant materials shall be identified by density and thickness required for a given fire-resistance rating.

**722.5.1.4 Concrete-protected columns.** The fire resistance of structural steel columns protected with concrete, as illustrated in Figure 722.5.1(6) (a) and (b), shall be permitted to be determined from the following expression:

$$R = R_o(1 + 0.03_m) \quad (\text{Equation 7-14})$$



For SI: 1 inch = 25.4 mm, 1 pound per linear foot/inch = 0.059 kg/m/mm.

FIGURE 722.5.1(4)  
FIRE RESISTANCE OF STRUCTURAL STEEL COLUMNS  
PROTECTED WITH VARIOUS THICKNESSES OF TYPE X  
GYPSUM WALLBOARD

- a. The W/D ratios for typical wide flange columns are listed in Table 721.5.1(1). For other column shapes, the W/D ratios shall be determined in accordance with Section 721.5.1.1.

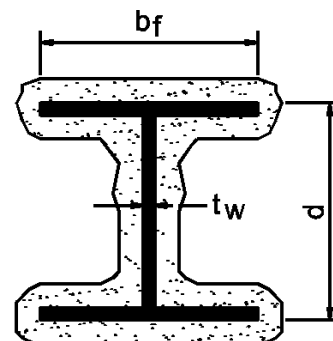


FIGURE 721.5.1(5)  
WIDE FLANGE STRUCTURE STEEL COLUMNS WITH  
SPRAYED FIRE-RESISTANT MATERIALS

where:

$$R_o = 10 (W/D)^{0.7} + 17 (h^{1.6}/k_c^{0.2}) \times [1 + 26 \{H/p_c h (L + h)\}^{0.8}]$$

As used in these expressions:

$R$  = Fire endurance at equilibrium moisture conditions (minutes).

$R_o$  = Fire endurance at zero moisture content (minutes).

$m$  = Equilibrium moisture content of the concrete by volume (percent).  
 $W$  = Average weight of the steel column (pounds per linear foot).  
 $D$  = Heated perimeter of the steel column (inches).  
 $h$  = Thickness of the concrete cover (inches).  
 $k_c$  = Ambient temperature thermal conductivity of the concrete (Btu/hr ft °F).

$H$  = Ambient temperature thermal capacity of the steel column =  $0.11W$  (Btu/ ft °F).  
 $p_c$  = Concrete density (pounds per cubic foot).  
 $c_c$  = Ambient temperature specific heat of concrete (Btu/lb °F).  
 $L$  = Interior dimension of one side of a square concrete box protection (inches).

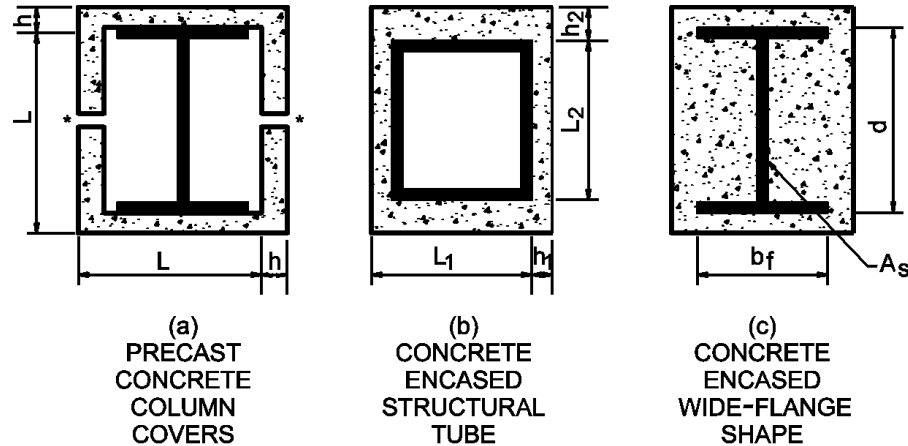
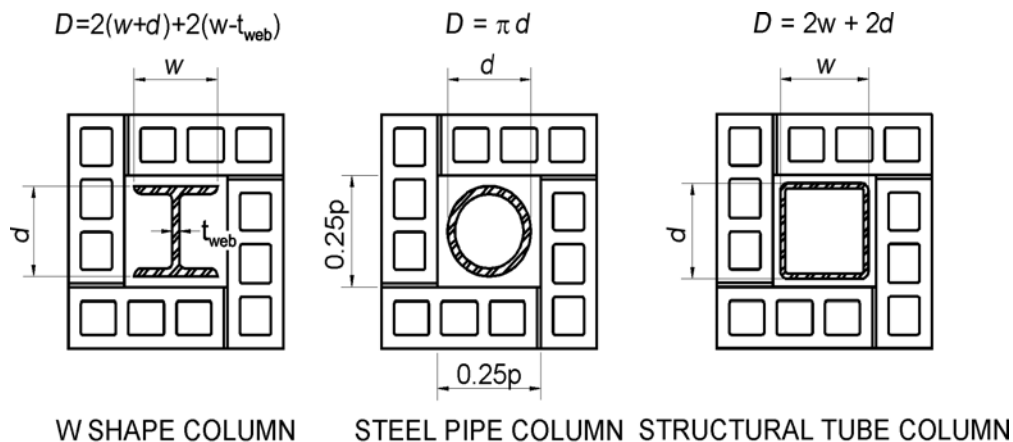


FIGURE 722.5.1(6)  
CONCRETE PROTECTED STRUCTURAL STEEL COLUMNS<sup>a,b</sup>

- a. When the inside perimeter of the concrete protection is not square,  $L$  shall be taken as the average of  $L_1$  and  $L_2$ . When the thickness of concrete cover is not constant,  $h$  shall be taken as the average of  $h_1$  and  $h_2$ .  
b. Joints shall be protected with a minimum 1 inch thickness of ceramic fiber blanket but in no case less than one-half the thickness of the column cover (see Section 722.2.1.3).



For SI: 1 inch = 25.4 mm.

$d$  = Depth of a wide flange column, outside diameter of pipe column, or outside dimension of structural tubing column (inches).  
 $t_{web}$  = Thickness of web of wide flange column (inches).  
 $w$  = Width of flange of wide flange column (inches).

FIGURE 722.5.1(7)  
CONCRETE OR CLAY MASONRY PROTECTED STRUCTURAL STEEL COLUMNS

# FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.5.1(1)**  
**W/D RATIOS FOR STEEL COLUMNS**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W14 × 233	2.55	3.65	W10 × 112	1.81	2.57
× 211	2.32	3.35	× 100	1.64	2.33
× 193	2.14	3.09	× 88	1.45	2.08
× 176	1.96	2.85	× 77	1.28	1.85
× 159	1.78	2.60	× 68	1.15	1.66
× 145	1.64	2.39	× 60	1.01	1.48
× 132	1.56	2.25	× 54	0.922	1.34
× 120	1.42	2.06	× 49	0.84	1.23
× 109	1.29	1.88	× 45	0.888	1.24
× 99	1.18	1.72	× 39	0.78	1.09
× 90	1.08	1.58	× 33	0.661	0.93
× 82	1.23	1.68			
× 74	1.12	1.53	W8 × 67	1.37	1.94
× 68	1.04	1.41	× 58	1.20	1.71
× 61	0.928	1.28	× 48	1.00	1.44
× 53	0.915	1.21	× 40	0.849	1.23
× 48	0.835	1.10	× 35	0.749	1.08
× 43	0.752	0.99	× 31	0.665	0.97
			× 28	0.688	0.96
W12 × 190	2.50	3.51	× 24	0.591	0.83
× 170	2.26	3.20	× 21	0.577	0.77
× 152	2.04	2.90	× 18	0.499	0.67
× 136	1.86	2.63			
× 120	1.65	2.36	W6 × 25	0.696	1.00
× 106	1.47	2.11	× 20	0.563	0.82
× 96	1.34	1.93	× 16	0.584	0.78
× 87	1.22	1.76	× 15	0.431	0.63
× 79	1.11	1.61	× 12	0.448	0.60
× 72	1.02	1.48	× 9	0.338	0.46
× 65	0.925	1.35			
× 58	0.925	1.31	W5 × 19	0.644	0.93
× 53	0.855	1.20	× 16	0.55	0.80
× 50	0.909	1.23			
× 45	0.829	1.12	W4 × 13	0.556	0.79
× 40	0.734	1.00			

For SI: 1 pound per linear foot per inch = 0.059 kg/m/mm.

**TABLE 722.5.1(2)**  
**PROPERTIES OF CONCRETE**

PROPERTY	NORMAL-WEIGHT CONCRETE	STRUCTURAL LIGHTWEIGHT CONCRETE
Thermal conductivity ( $k_c$ )	0.95 Btu/hr • ft • °F	0.35 Btu/hr • ft • °F
Specific heat ( $c_c$ )	0.20 Btu/lb °F	0.20 Btu/lb °F
Density ( $P_c$ )	145 lb/ft <sup>3</sup>	110 lb/ft <sup>3</sup>
Equilibrium (free) moisture content (m) by volume	4%	5%

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb/ft<sup>3</sup> = 16.0185 kg/m<sup>3</sup>, Btu/hr • ft • °F = 1.731 W/(m • K).

**TABLE 722.5.1(3)**  
**THERMAL CONDUCTIVITY OF CONCRETE OR CLAY MASONRY UNITS**

DENSITY ( $d_m$ ) OF UNITS (lb/ft <sup>3</sup> )	THERMAL CONDUCTIVITY ( $k$ ) OF UNITS (Btu/hr · ft · °F)
<b>Concrete Masonry Units</b>	
80	0.207
85	0.228
90	0.252
95	0.278
100	0.308
105	0.340
110	0.376
115	0.416
120	0.459
125	0.508
130	0.561
135	0.620
140	0.685
145	0.758
150	0.837
<b>Clay Masonry Units</b>	
120	1.25
130	2.25

For SI: 1 pound per cubic foot = 16.0185 kg/m<sup>3</sup>, Btu/hr · ft · °F = 1.731 W/(m · K).

**TABLE 722.5.1(4)**  
**WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W36 x 300	2.50	3.33	W24 x 68	0.942	1.21
x 280	2.35	3.12	x 62	0.934	1.14
x 260	2.18	2.92	x 55	0.828	1.02
x 245	2.08	2.76			
x 230	1.95	2.61	W21 x 147	1.87	2.60
x 210	1.96	2.45	x 132	1.68	2.35
x 194	1.81	2.28	x 122	1.57	2.19
x 182	1.72	2.15	x 111	1.43	2.01
x 170	1.60	2.01	x 101	1.30	1.84
x 160	1.51	1.90	x 93	1.40	1.80
x 150	1.43	1.79	x 83	1.26	1.62
x 135	1.29	1.63	x 73	1.11	1.44
			x 68	1.04	1.35

*(continued)*

**TABLE 722.5.1(4)—continued**  
**WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W33 x 241	2.13	2.86	W21 x 62	0.952	1.23
x 221	1.97	2.64	x 57	0.952	1.17
x 201	1.79	2.42	x 50	0.838	1.04
x 152	1.53	1.94	x 44	0.746	0.92
x 141	1.43	1.80			
x 130	1.32	1.67	W18 x 119	1.72	2.42
x 118	1.21	1.53	x 106	1.55	2.18
			x 97	1.42	2.01
W30 x 211	2.01	2.74	x 86	1.27	1.80
x 191	1.85	2.50	x 76	1.13	1.60
x 173	1.66	2.28	x 71	1.22	1.59
x 132	1.47	1.85	x 65	1.13	1.47
x 124	1.39	1.75	x 60	1.04	1.36
x 116	1.30	1.65	x 55	0.963	1.26
x 108	1.21	1.54	x 50	0.88	1.15
x 99	1.12	1.42	x 46	0.878	1.09
			x 40	0.768	0.96
W27 x 178	1.87	2.55	x 35	0.672	0.85
x 161	1.70	2.33			
x 146	1.55	2.12	W16 x 100	1.59	2.25
x 114	1.39	1.76	x 89	1.43	2.03
x 102	1.24	1.59	x 77	1.25	1.78
x 94	1.15	1.47	x 67	1.09	1.56
x 84	1.03	1.33	x 57	1.09	1.43
			x 50	0.962	1.26
			x 45	0.870	1.15
W24 x 162	1.88	2.57	x 40	0.780	1.03
x 146	1.70	2.34	x 36	0.702	0.93
x 131	1.54	2.12	x 31	0.661	0.83
x 117	1.38	1.91	x 26	0.558	0.70
x 104	1.24	1.71			
x 94	1.28	1.63	W14 x 132	1.89	3.00
x 84	1.15	1.47	x 120	1.71	2.75
x 76	1.05	1.34	x 109	1.57	2.52
W14 x 99	1.43	2.31	W10 x 30	0.806	1.12
x 90	1.31	2.11	x 26	0.708	0.98
x 82	1.45	2.12	x 22	0.606	0.84
x 74	1.32	1.93	x 19	0.607	0.78
x 68	1.22	1.78	x 17	0.543	0.70
x 61	1.10	1.61	x 15	0.484	0.63
x 53	1.06	1.48	x 12	0.392	0.51
x 48	0.970	1.35			

(continued)



**TABLE 722.5.1(4)—continued**  
**WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W14 x 43	0.874	1.22	W8 x 67	1.65	2.55
x 38	0.809	1.09	x 58	1.44	2.26
x 34	0.725	0.98	x 48	1.21	1.91
x 30	0.644	0.87	x 40	1.03	1.63
x 26	0.628	0.79	x 35	0.907	1.44
x 22	0.534	0.68	x 31	0.803	1.29
			x 28	0.819	1.24
W12 x 87	1.47	2.34	x 24	0.704	1.07
x 79	1.34	2.14	x 21	0.675	0.96
x 72	1.23	1.97	x 18	0.583	0.84
x 65	1.11	1.79	x 15	0.551	0.74
x 58	1.10	1.69	x 13	0.483	0.65
x 53	1.02	1.55	x 10	0.375	0.51
x 50	1.06	1.54			
x 45	0.974	1.40	W6 x 25	0.839	1.33
x 40	0.860	1.25	x 20	0.678	1.09
x 35	0.810	1.11	x 16	0.684	0.96
x 30	0.699	0.96	x 15	0.521	0.83
x 26	0.612	0.84	x 12	0.526	0.75
x 22	0.623	0.77	x 9	0.398	0.57
x 19	0.540	0.67			
x 16	0.457	0.57	W5 x 19	0.776	1.24
x 14	0.405	0.50	x 16	0.664	1.07
W10 x 112	2.17	3.38	W4 x 13	0.670	1.05
x 100	1.97	3.07			
x 88	1.74	2.75			
x 77	1.54	2.45			
x 68	1.38	2.20			
x 60	1.22	1.97			
x 54	1.11	1.79			
x 49	1.01	1.64			
x 45	1.06	1.59			
x 39	0.94	1.40			
x 33	0.77	1.20			

For SI: 1 pound per linear foot per inch = 0.059 kg/m/mm.

**TABLE 722.5.1(5)**  
**FIRE RESISTANCE OF CONCRETE MASONRY PROTECTED STEEL COLUMNS**

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)				COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
W14 × 82	80	0.74	1.61	2.36	3.04	W10 × 68	80	0.72	1.58	2.33	3.01
	100	0.89	1.85	2.67	3.40		100	0.87	1.83	2.65	3.38
	110	0.96	1.97	2.81	3.57		110	0.94	1.95	2.79	3.55
	120	1.03	2.08	2.95	3.73		120	1.01	2.06	2.94	3.72
W14 × 68	80	0.83	1.70	2.45	3.13	W10 × 54	80	0.88	1.76	2.53	3.21
	100	0.99	1.95	2.76	3.49		100	1.04	2.01	2.83	3.57
	110	1.06	2.06	2.91	3.66		110	1.11	2.12	2.98	3.73
	120	1.14	2.18	3.05	3.82		120	1.19	2.24	3.12	3.90
W14 × 53	80	0.91	1.81	2.58	3.27	W10 × 45	80	0.92	1.83	2.60	3.30
	100	1.07	2.05	2.88	3.62		100	1.08	2.07	2.90	3.64
	110	1.15	2.17	3.02	3.78		110	1.16	2.18	3.04	3.80
	120	1.22	2.28	3.16	3.94		120	1.23	2.29	3.18	3.96
W14 × 43	80	1.01	1.93	2.71	3.41	W10 × 33	80	1.06	2.00	2.79	3.49
	100	1.17	2.17	3.00	3.74		100	1.22	2.23	3.07	3.81
	110	1.25	2.28	3.14	3.90		110	1.30	2.34	3.20	3.96
	120	1.32	2.38	3.27	4.05		120	1.37	2.44	3.33	4.12
W12 × 72	80	0.81	1.66	2.41	3.09	W8 × 40	80	0.94	1.85	2.63	3.33
	100	0.91	1.88	2.70	3.43		100	1.10	2.10	2.93	3.67
	110	0.99	1.99	2.84	3.60		110	1.18	2.21	3.07	3.83
	120	1.06	2.10	2.98	3.76		120	1.25	2.32	3.20	3.99
W12 × 58	80	0.88	1.76	2.52	3.21	W8 × 31	80	1.06	2.00	2.78	3.49
	100	1.04	2.01	2.83	3.56		100	1.22	2.23	3.07	3.81
	110	1.11	2.12	2.97	3.73		110	1.29	2.33	3.20	3.97
	120	1.19	2.23	3.11	3.89		120	1.36	2.44	3.33	4.12
W12 × 50	80	0.91	1.81	2.58	3.27	W8 × 24	80	1.14	2.09	2.89	3.59
	100	1.07	2.05	2.88	3.62		100	1.29	2.31	3.16	3.90
	110	1.15	2.17	3.02	3.78		110	1.36	2.42	3.28	4.05
	120	1.22	2.28	3.16	3.94		120	1.43	2.52	3.41	4.20
W12 × 40	80	1.01	1.94	2.72	3.41	W8 × 18	80	1.22	2.20	3.01	3.72
	100	1.17	2.17	3.01	3.75		100	1.36	2.40	3.25	4.01
	110	1.25	2.28	3.14	3.90		110	1.42	2.50	3.37	4.14
	120	1.32	2.39	3.27	4.06		120	1.48	2.59	3.49	4.28
4 × 4 × 1/2 wall thickness	80	0.93	1.90	2.71	3.43	4 double extra strong 0.674 wall thickness	80	0.80	1.75	2.56	3.28
	100	1.08	2.13	2.99	3.76		100	0.95	1.99	2.85	3.62
	110	1.16	2.24	3.13	3.91		110	1.02	2.10	2.99	3.78
	120	1.22	2.34	3.26	4.06		120	1.09	2.20	3.12	3.93
4 × 4 × 3/8 wall thickness	80	1.05	2.03	2.84	3.57	4 extra strong 0.337 wall thickness	80	1.12	2.11	2.93	3.65
	100	1.20	2.25	3.11	3.88		100	1.26	2.32	3.19	3.95
	110	1.27	2.35	3.24	4.02		110	1.33	2.42	3.31	4.09
	120	1.34	2.45	3.37	4.17		120	1.40	2.52	3.43	4.23

(continued)

**TABLE 722.5.1(5)—continued**  
**FIRE RESISTANCE OF CONCRETE MASONRY PROTECTED STEEL COLUMNS**

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)				COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
$4 \times 4 \times \frac{1}{4}$ wall thickness	80	1.21	2.20	3.01	3.73	4 standard 0.237 wall thickness	80	1.26	2.25	3.07	3.79
	100	1.35	2.40	3.26	4.02		100	1.40	2.45	3.31	4.07
	110	1.41	2.50	3.38	4.16		110	1.46	2.55	3.43	4.21
	120	1.48	2.59	3.50	4.30		120	1.53	2.64	3.54	4.34
$6 \times 6 \times \frac{1}{2}$ wall thickness	80	0.82	1.75	2.54	3.25	5 double extra strong 0.750 wall thickness	80	0.70	1.61	2.40	3.12
	100	0.98	1.99	2.84	3.59		100	0.85	1.86	2.71	3.47
	110	1.05	2.10	2.98	3.75		110	0.91	1.97	2.85	3.63
	120	1.12	2.21	3.11	3.91		120	0.98	2.02	2.99	3.79
$6 \times 6 \times \frac{3}{8}$ wall thickness	80	0.96	1.91	2.71	3.42	5 extra strong 0.375 wall thickness	80	1.04	2.01	2.83	3.54
	100	1.12	2.14	3.00	3.75		100	1.19	2.23	3.09	3.85
	110	1.19	2.25	3.13	3.90		110	1.26	2.34	3.22	4.00
	120	1.26	2.35	3.26	4.05		120	1.32	2.44	3.34	4.14
$6 \times 6 \times \frac{1}{4}$ wall thickness	80	1.14	2.11	2.92	3.63	5 standard 0.258 wall thickness	80	1.20	2.19	3.00	3.72
	100	1.29	2.32	3.18	3.93		100	1.34	2.39	3.25	4.00
	110	1.36	2.43	3.30	4.08		110	1.41	2.49	3.37	4.14
	120	1.42	2.52	3.43	4.22		120	1.47	2.58	3.49	4.28
$8 \times 8 \times \frac{1}{2}$ wall thickness	80	0.77	1.66	2.44	3.13	6 double extra strong 0.864 wall thickness	80	0.59	1.46	2.23	2.92
	100	0.92	1.91	2.75	3.49		100	0.73	1.71	2.54	3.29
	110	1.00	2.02	2.89	3.66		110	0.80	1.82	2.69	3.47
	120	1.07	2.14	3.03	3.82		120	0.86	1.93	2.83	3.63
$8 \times 8 \times \frac{3}{8}$ wall thickness	80	0.91	1.84	2.63	3.33	6 extra strong 0.432 wall thickness	80	0.94	1.90	2.70	3.42
	100	1.07	2.08	2.92	3.67		100	1.10	2.13	2.98	3.74
	110	1.14	2.19	3.06	3.83		110	1.17	2.23	3.11	3.89
	120	1.21	2.29	3.19	3.98		120	1.24	2.34	3.24	4.04
$8 \times 8 \times \frac{1}{4}$ wall thickness	80	1.10	2.06	2.86	3.57	6 standard 0.280 wall thickness	80	1.14	2.12	2.93	3.64
	100	1.25	2.28	3.13	3.87		100	1.29	2.33	3.19	3.94
	110	1.32	2.38	3.25	4.02		110	1.36	2.43	3.31	4.08
	120	1.39	2.48	3.38	4.17		120	1.42	2.53	3.43	4.22

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m<sup>3</sup>.

**Note:** Tabulated values assume 1-inch air gap between masonry and steel section.

**TABLE 722.5.1(6)**  
**FIRE RESISTANCE OF CLAY MASONRY PROTECTED STEEL COLUMNS**

COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)				COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
W14 × 82	120	1.23	2.42	3.41	4.29	W10 × 68	120	1.27	2.46	3.26	4.35
	130	1.40	2.70	3.78	4.74		130	1.44	2.75	3.83	4.80
W14 × 68	120	1.34	2.54	3.54	4.43	W10 × 54	120	1.40	2.61	3.62	4.51
	130	1.51	2.82	3.91	4.87		130	1.58	2.89	3.98	4.95
W14 × 53	120	1.43	2.65	3.65	4.54	W10 × 45	120	1.44	2.66	3.67	4.57
	130	1.61	2.93	4.02	4.98		130	1.62	2.95	4.04	5.01
W14 × 43	120	1.54	2.76	3.77	4.66	W10 × 33	120	1.59	2.82	3.84	4.73
	130	1.72	3.04	4.13	5.09		130	1.77	3.10	4.20	5.13
W12 × 72	120	1.32	2.52	3.51	4.40	W8 × 40	120	1.47	2.70	3.71	4.61
	130	1.50	2.80	3.88	4.84		130	1.65	2.98	4.08	5.04
W12 × 58	120	1.40	2.61	3.61	4.50	W8 × 31	120	1.59	2.82	3.84	4.73
	130	1.57	2.89	3.98	4.94		130	1.77	3.10	4.20	5.17
W12 × 50	120	1.43	2.65	3.66	4.55	W8 × 24	120	1.66	2.90	3.92	4.82
	130	1.61	2.93	4.02	4.99		130	1.84	3.18	4.28	5.25
W12 × 40	120	1.54	2.77	3.78	4.67	W8 × 18	120	1.75	3.00	4.01	4.91
	130	1.72	3.05	4.14	5.10		130	1.93	3.27	4.37	5.34
<b>STEEL TUBING</b>						<b>STEEL PIPE</b>					
NOMINAL TUBE SIZE (inches)	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)				NOMINAL PIPE SIZE (inches)	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, $T_e$ (inches)			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
4 × 4 × 1/2 wall thickness	120	1.44	2.72	3.76	4.68	4 double extra strong 0.674 wall thickness	120	1.26	2.55	3.60	4.52
	130	1.62	3.00	4.12	5.11		130	1.42	2.82	3.96	4.95
4 × 4 × 3/8 wall thickness	120	1.56	2.84	3.88	4.78	4 extra strong 0.337 wall thickness	120	1.60	2.89	3.92	4.83
	130	1.74	3.12	4.23	5.21		130	1.77	3.16	4.28	5.25
4 × 4 × 1/4 wall thickness	120	1.72	2.99	4.02	4.92	4 standard 0.237 wall thickness	120	1.74	3.02	4.05	4.95
	130	1.89	3.26	4.37	5.34		130	1.92	3.29	4.40	5.37
6 × 6 × 1/2 wall thickness	120	1.33	2.58	3.62	4.52	5 double extra strong 0.750 wall thickness	120	1.17	2.44	3.48	4.40
	130	1.50	2.86	3.98	4.96		130	1.33	2.72	3.84	4.83
6 × 6 × 3/8 wall thickness	120	1.48	2.74	3.76	4.67	5 extra strong 0.375 wall thickness	120	1.55	2.82	3.85	4.76
	130	1.65	3.01	4.13	5.10		130	1.72	3.09	4.21	5.18
6 × 6 × 1/4 wall thickness	120	1.66	2.91	3.94	4.84	5 standard 0.258 wall thickness	120	1.71	2.97	4.00	4.90
	130	1.83	3.19	4.30	5.27		130	1.88	3.24	4.35	5.32
8 × 8 × 1/2 wall thickness	120	1.27	2.50	3.52	4.42	6 double extra strong 0.864 wall thickness	120	1.04	2.28	3.32	4.23
	130	1.44	2.78	3.89	4.86		130	1.19	2.60	3.68	4.67
8 × 8 × 3/8 wall thickness	120	1.43	2.67	3.69	4.59	6 extra strong 0.432 wall thickness	120	1.45	2.71	3.75	4.65
	130	1.60	2.95	4.05	5.02		130	1.62	2.99	4.10	5.08
8 × 8 × 1/4 wall thickness	120	1.62	2.87	3.89	4.78	6 standard 0.280 wall thickness	120	1.65	2.91	3.94	4.84
	130	1.79	3.14	4.24	5.21		130	1.82	3.19	4.30	5.27

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m<sup>3</sup>.

**TABLE 722.5.1(7)**  
**MINIMUM COVER (inch) FOR STEEL COLUMNS ENCASED IN**  
**NORMAL-WEIGHT CONCRETE<sup>a</sup> [FIGURE 722.5.1(6)(c)]**

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
W14 × 233	1	1	1	1½	2
× 176				2	2½
× 132			1½		
× 90		2		3	
× 61		2½			
× 48					
× 43					
W12 × 152	1	1	1	2	2½
× 96		1½	1½	2½	3
× 65					
× 50					
× 40					
W10 × 88	1	1½	1½	2	3
× 49	1			2½	
× 45					
× 39					
× 33					
W8 × 67	1	1	1½	2½	3
× 58		1½			2
× 48					
× 31					
× 21					
× 18					
W6 × 25	1	1½	2	3	3½
× 20		2	2½	3½	4
× 16					
× 15					
× 9					

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 722.5.1(2).

**TABLE 722.5.1(8)**  
**MINIMUM COVER (inch) FOR STEEL COLUMNS ENCASED IN**  
**STRUCTURAL LIGHTWEIGHT CONCRETE<sup>a</sup> [FIGURE**  
**722.5.1(6)(c)]**

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (HOURS)				
	1	1½	2	3	4
W14 × 233	1	1	1	1	1½
× 193				1½	
× 74					2½
× 61				2	
× 43			1½		
W12 × 65	1	1	1	1½	2
× 53			1½	2	2½
× 40				1½	
W10 × 112	1	1	1	1½	2
× 88				2	2½
× 60			1½		
× 33					
W8 × 35	1	1	1½	2	2½
× 28				2½	3
× 24					
× 18		1½			

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of structural lightweight concrete given in Table 722.5.1(2).

# FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.5.1(9)**  
**MINIMUM COVER (inch) FOR STEEL COLUMNS IN NORMAL-WEIGHT PRECAST COVERS<sup>a</sup> [FIGURE 722.5.1(6)(a)]**

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
W14 × 233	1½	1½	1½	2½	3
× 211			2	3	3½
× 176					
× 145		2	2½	3	4
× 109					
× 99					
× 61					
× 43				3½	4½
W12 × 190	1½	1½	1½	2½	3½
× 152			2	3	4
× 120					
× 96		2	2½	3½	4½
× 87					
× 58					
× 40					
W10 × 112	1½	1½	2	3	3½
× 88		2	2½	3½	4½
× 77					
× 54					
× 33					
W8 × 67	1½	1½	2	3	4
× 58		2	2½	3½	4½
× 48					
× 28					
× 21		2½	3	4	4½
× 18					
W6 × 25	1½	2	2½	3½	4½
× 20		2½	3	4	5
× 16					
× 12					
× 9					

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 722.5.1(2).

**TABLE 722.5.1(10)**  
**MINIMUM COVER (inch) FOR STEEL COLUMNS IN STRUCTURAL LIGHTWEIGHT PRECAST COVERS<sup>a</sup> [FIGURE 722.5.1(6)(a)]**

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
W14 × 233	1½	1½	1½	2	2½
× 176				2½	3
× 145					
× 132			2	3	3½
× 109					
× 99			2	3	3½
× 68					
× 43					
W12 × 190	1½	1½	1½	2	2½
× 152				2½	3
× 136					
× 106			2	3	3½
× 96					
× 87			2	3	3½
× 65					
× 40					
W10 × 112	1½	1½	1½	2	3
× 100			2	3	3½
× 88					
× 77					
× 60					
W8 × 67	1½	1½	1½	2½	3
× 48			2	3	3½
× 35					
× 28					
× 18			2½	3	3½
W6 × 25					
× 15	1½	2	2	3	4
× 9			2½	3½	4

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of structural lightweight concrete given in Table 722.5.1(2).

**722.5.1.4.1 Reentrant space filled.** For wide-flange steel columns completely encased in concrete with all reentrant spaces filled [Figure 722.5.1(6)(c)], the thermal capacity of the concrete within the reentrant spaces shall be permitted to be added to the thermal capacity of the steel column, as follows:

$$H = 0.11 W + (p_c c_c / 144) (b_f d - A_s) \quad (\text{Equation 7-15})$$

where:

$b_f$  = Flange width of the steel column (inches).

$d$  = Depth of the steel column (inches).

$A_s$  = Cross-sectional area of the steel column (square inches).

**722.5.1.4.2 Concrete properties unknown.** If specific data on the properties of concrete are not available, the values given in Table 722.5.1(2) are permitted.

**722.5.1.4.3 Minimum concrete cover.** For structural steel column encased in concrete with all reentrant spaces filled, Figure 722.5.1(6)(c) and Tables 722.5.1(7) and 722.5.1(8) indicate the thickness of concrete cover required for various fire-resistance ratings for typical wide-flange sections. The thicknesses of concrete indicated in these tables also apply to structural steel columns larger than those listed.

**722.5.1.4.4 Minimum precast concrete cover.** For structural steel columns protected with precast concrete column covers as shown in Figure 722.5.1(6)(a), Tables 722.5.1(9) and 722.5.1(10) indicate the thickness of the column covers required for various fire-resistance ratings for typical wide-flange shapes. The thicknesses of concrete given in these tables also apply to structural steel columns larger than those listed.

**722.5.1.4.5 Masonry protection.** The fire resistance of structural steel columns protected with concrete masonry units or clay masonry units as illustrated in Figure 722.5.1(7), shall be permitted to be determined from the following expression:

$$R = 0.17 (W/D)^{0.7} + [0.285 (T_e^{1.6}/K^{0.2})] [1.0 + 42.7 \{(A_s/d_m T_e)/(0.25p + T_e)\}^{0.8}] \quad (\text{Equation 7-16})$$

where:

$R$  = Fire-resistance rating of column assembly (hours).

$W$  = Average weight of steel column (pounds per foot).

$D$  = Heated perimeter of steel column (inches) [see Figure 722.5.1(7)].

$T_e$  = Equivalent thickness of concrete or clay masonry unit (inches) (see Table 722.3.2 Note a or Section 722.4.1).

$K$  = Thermal conductivity of concrete or clay masonry unit (Btu/hr · ft · °F) [see Table 722.5.1(3)].

$A_s$  = Cross-sectional area of steel column (square inches).

$d_m$  = Density of the concrete or clay masonry unit (pounds per cubic foot).

$p$  = Inner perimeter of concrete or clay masonry protection (inches) [see Figure 722.5.1(7)].

**722.5.1.4.6 Equivalent concrete masonry thickness.** For structural steel columns protected with concrete masonry, Table 722.5.1(5) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes. For structural steel columns protected with clay masonry, Table 722.5.1(6) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes.

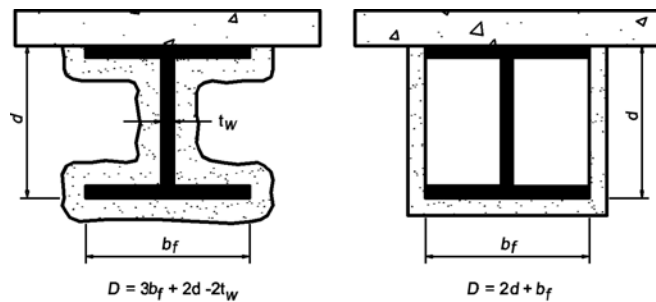
**722.5.2 Structural steel beams and girders.** The fire-resistance ratings of steel beams and girders shall be based upon the size of the element and the type of protection provided in accordance with this section.

**722.5.2.1 Determination of fire resistance.** These procedures establish a basis for determining resistance of structural steel beams and girders which differ in size from that specified in approved fire-resistance-rated assemblies as a function of the thickness of fire-resistant material and the weight ( $W$ ) and heated perimeter ( $D$ ) of the beam or girder. As used in these sections,  $W$  is the average weight of a structural steel member in pounds per linear foot (plf). The heated perimeter,  $D$ , is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 722.5.2.

**722.5.2.1.1 Weight-to-heated perimeter.** The weight-to-heated-perimeter ratios ( $W/D$ ), for both contour and box fire-resistant protection profiles, for the wide flange shapes most often used as beams or girders are given in Table 722.5.1(4). For different shapes, the weight-to-heated-perimeter ratios ( $W/D$ ) shall be determined in accordance with the definitions given in this section.

**722.5.2.1.2 Beam and girder substitutions.** Except as provided for in Section 722.5.2.2, structural steel beams in approved fire-resistance-rated assemblies shall be considered the minimum permissible size. Other beam or girder shapes shall be permitted to be substituted provided that the weight-to-heated-perimeter ratio ( $W/D$ ) of the substitute beam is equal to or greater than that of the beam specified in the approved assembly.

**722.5.2.2 Sprayed fire-resistant materials.** The provisions in this section apply to structural steel beams and girders protected with sprayed fire-resistant materials. Larger or smaller beam and girder shapes shall be permitted to be substituted for beams specified in approved unrestrained or restrained fire-resistance-rated assemblies, provided that the thickness of the fire-



**FIGURE 722.5.2**  
**DETERMINATION OF THE HEATED PERIMETER OF**  
**STRUCTURAL STEEL BEAMS AND GIRDERS**

resistant material is adjusted in accordance with the following expression:

$$h_2 = h_1 [(W_1 / D_1) + 0.60] / [(W_2 / D_2) + 0.60] \quad (\text{Equation 7-17})$$

where:

- $h$  = Thickness of sprayed fire-resistant material in inches.
- $W$  = Weight of the structural steel beam or girder in pounds per linear foot.
- $D$  = Heated perimeter of the structural steel beam in inches.

Subscript 1 refers to the beam and fire-resistant material thickness in the approved assembly.

Subscript 2 refers to the substitute beam or girder and the required thickness of fire-resistant material.

The fire resistance of structural steel beams and girders protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

**722.5.2.2.1 Minimum thickness.** The use of Equation 7-17 is subject to the following conditions:

1. The weight-to-heated-perimeter ratio for the substitute beam or girder ( $W_2/D_2$ ) shall not be less than 0.37.
2. The thickness of fire protection materials calculated for the substitute beam or girder ( $T_1$ ) shall not be less than  $\frac{3}{8}$  inch (9.5 mm).
3. The unrestrained or restrained beam rating shall not be less than 1 hour.
4. When used to adjust the material thickness for a restrained beam, the use of this procedure is limited to steel sections classified as compact in accordance with the AISC *Specification for Structural Steel Buildings*, (AISC 360-05).

**722.5.2.3 Structural steel trusses.** The fire resistance of structural steel trusses protected with fire-resistant materials sprayed to each of the individual truss elements shall be permitted to be determined in accordance with this section. The thickness of the fire-

resistant material shall be determined in accordance with Section 722.5.1.3. The weight-to-heated-perimeter ratio ( $W/D$ ) of truss elements that can be simultaneously exposed to fire on all sides shall be determined on the same basis as columns, as specified in Section 722.5.1.1. The weight-to-heated-perimeter ratio ( $W/D$ ) of truss elements that directly support floor or roof assembly shall be determined on the same basis as beams and girders, as specified in Section 722.5.2.1.

The fire resistance of structural steel trusses protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

**722.6 Wood assemblies.** The provisions of this section contain procedures by which the fire-resistance ratings of wood assemblies are established by calculations.

**722.6.1 General.** This section contains procedures for calculating the fire-resistance ratings of walls, floor/ceiling and roof/ceiling assemblies based in part on the standard method of testing referenced in Section 703.2.

**722.6.1.1 Maximum fire-resistance rating.** Fire resistance ratings calculated for assemblies using the methods in Section 722.6 shall be limited to a maximum of 1 hour.

**722.6.1.2 Dissimilar membranes.** Where dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.

**722.6.2 Walls, floors and roofs.** These procedures apply to both load-bearing and nonload-bearing assemblies.

**722.6.2.1 Fire-resistance rating of wood frame assemblies.** The fire-resistance rating of a wood frame assembly is equal to the sum of the time assigned to the membrane on the fire-exposed side, the time assigned to the framing members and the time assigned for additional contribution by other protective measures such as insulation. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly.

**722.6.2.2 Time assigned to membranes.** Table 722.6.2(1) indicates the time assigned to membranes on the fire-exposed side.

**722.6.2.3 Exterior walls.** For an exterior wall with a fire separation distance greater than 10 feet (3048 mm), the wall is assigned a rating dependant on the interior membrane and the framing as described in Tables 722.6.2(1) and 722.6.2(2). The membrane on the outside of the nonfire-exposed side of exterior walls with a fire separation distance greater than 10 feet (3048 mm) may consist of sheathing, sheathing paper and siding as described in Table 722.6.2(3).

**722.6.2.4 Floors and roofs.** In the case of a floor or roof, the standard test provides only for testing for fire exposure from below. Except as noted in Section 703.3, Item 5, floor or roof assemblies of wood framing shall have an upper membrane consisting of a subfloor and finished floor conforming to Table 722.6.2(4) or any



other membrane that has a contribution to fire resistance of at least 15 minutes in Table 722.6.2(1).

**722.6.2.5 Additional protection.** Table 722.6.2(5) indicates the time increments to be added to the fire resistance where glass fiber, rockwool, slag mineral wool or cellulose insulation is incorporated in the assembly.

**722.6.2.6 Fastening.** Fastening of wood frame assemblies and the fastening of membranes to the wood framing members shall be done in accordance with Chapter 23.

**722.6.3 Design of fire-resistant exposed wood members.** The fire-resistance rating, in minutes, of timber beams and columns with a minimum nominal dimension of 6 inches (152 mm) is equal to:

Beams:  $2.54Zb [4 - 2(b/d)]$  for beams which may be exposed to fire on four sides.  
(Equation 7-18)

**TABLE 722.6.2(1)**  
**TIME ASSIGNED TO WALLBOARD MEMBRANES<sup>a, b, c, d</sup>**

DESCRIPTION OF FINISH	TIME <sup>a</sup> (minutes)
$3/8$ -inch wood structural panel bonded with exterior glue	5
$15/32$ -inch wood structural panel bonded with exterior glue	10
$19/32$ -inch wood structural panel bonded with exterior glue	15
$3/8$ -inch gypsum wallboard	10
$1/2$ -inch gypsum wallboard	15
$5/8$ -inch gypsum wallboard	30
$1/2$ -inch Type X gypsum wallboard	25
$5/8$ -inch Type X gypsum wallboard	40
Double $3/8$ -inch gypsum wallboard	25
$1/2$ -inch + $3/8$ -inch gypsum wallboard	35
Double $1/2$ -inch gypsum wallboard	40

For SI: 1 inch = 25.4 mm.

- These values apply only when membranes are installed on framing members which are spaced 16 inches o.c. or less.
- Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except  $5/8$ -inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported but finished.
- On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.
- The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly. When dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.
- The time assigned is not a finished rating.

$2.54Zb [4 - (b/d)]$  for beams which may be exposed to fire on three sides.  
(Equation 7-19)

Columns:  $2.54Zd [3 - (d/b)]$  for columns which may be exposed to fire on four sides  
(Equation 7-20)

$2.54Zd [3 - (d/2b)]$  for columns which may be exposed to fire on three sides.  
(Equation 7-21)

where:

$b$  = The breadth (width) of a beam or larger side of a column before exposure to fire (inches).

$d$  = The depth of a beam or smaller side of a column before exposure to fire (inches).

$Z$  = Load factor, based on Figure 722.6.3(1).

**722.6.3.1 Equation 7-21.** Equation 7-21 applies only where the unexposed face represents the smaller side of the column. If a column is recessed into a wall, its full dimension shall be used for the purpose of these calculations.

**722.6.3.2 Allowable loads.** Allowable loads on beams and columns are determined using design values given in AF&PA NDS.

**722.6.3.3 Fastener protection.** Where minimum 1-hour fire resistance is required, connectors and fasteners shall be protected from fire exposure by  $1\frac{1}{2}$  inches (38 mm) of wood, or other approved covering or coating for a 1-hour rating. Typical details for commonly used fasteners and connectors are shown in AITC Technical Note 7.

**722.6.3.4 Minimum size.** Wood members are limited to dimensions of 6 inches (152 mm) nominal or greater. Glued-laminated timber beams utilize standard laminating combinations except that a core lamination is removed. The tension zone is moved inward and the equivalent of an extra nominal 2-inch-thick (51 mm) outer tension lamination is added.

## FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.6.2(2)**  
**TIME ASSIGNED FOR CONTRIBUTION OF WOOD FRAME** <sup>a, b, c</sup>

DESCRIPTION	TIME ASSIGNED TO FRAME (minutes)
Wood studs 16 inches o.c.	20
Wood floor and roof joists 16 inches o.c.	10

For SI: 1 inch = 25.4 mm.

- a. This table does not apply to studs or joists spaced more than 16 inches o.c.  
b. All studs shall be nominal 2 × 4 and all joists shall have a nominal thickness of at least 2 inches.  
c. Allowable spans for joists shall be determined in accordance with Sections 2308.8, 2308.10.2 and 2308.10.3.

**TABLE 722.6.2(3)**  
**MEMBRANE<sup>a</sup> ON EXTERIOR FACE OF WOOD STUD WALLS**

SHEATHING	PAPER	EXTERIOR FINISH
<sup>5</sup> / <sub>8</sub> -inch T & G lumber <sup>5</sup> / <sub>16</sub> -inch exterior glue wood structural panel <sup>1</sup> / <sub>2</sub> -inch gypsum wallboard <sup>5</sup> / <sub>8</sub> -inch gypsum wallboard <sup>1</sup> / <sub>2</sub> -inch fiberboard	Sheathing paper	Lumber siding Wood shingles and shakes <sup>1</sup> / <sub>4</sub> -inch wood structural panels-exterior type <sup>1</sup> / <sub>4</sub> -inch hardboard Metal siding Stucco on metal lath Masonry veneer Vinyl siding
None	—	<sup>3</sup> / <sub>8</sub> -inch exterior-grade wood structural panels

For SI: 1 pound/cubic foot = 16.0185 kg/m<sup>3</sup>.

- a. Any combination of sheathing, paper and exterior finish is permitted.

**TABLE 722.6.2(4)**  
**FLOORING OR ROOFING OVER WOOD FRAMING<sup>a</sup>**

ASSEMBLY	STRUCTURAL MEMBERS	SUBFLOOR OR ROOF DECK	FINISHED FLOORING OR ROOFING
Floor	Wood	<sup>15</sup> / <sub>32</sub> -inch wood structural panels or <sup>11</sup> / <sub>16</sub> -inch T & G softwood	Hardwood or softwood flooring on building paper resilient flooring, parquet floor felted-synthetic fiber floor coverings, carpeting, or ceramic tile on <sup>3</sup> / <sub>8</sub> -inch-thick panel-type underlay Ceramic tile on 1 <sup>1</sup> / <sub>4</sub> -inch mortar bed
Roof	Wood	<sup>15</sup> / <sub>32</sub> -inch wood structural panels or <sup>11</sup> / <sub>16</sub> -inch T & G softwood	Finished roofing material with or without insulation

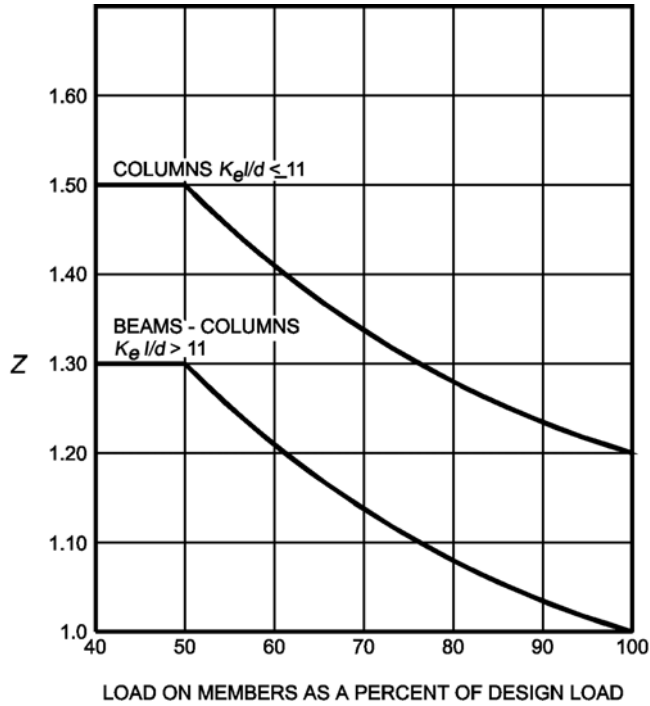
For SI: 1 inch = 25.4 mm.

- a. This table applies only to wood joist construction. It is not applicable to wood truss construction.

**TABLE 722.6.2(5)**  
**TIME ASSIGNED FOR ADDITIONAL PROTECTION**

DESCRIPTION OF ADDITIONAL PROTECTION	FIRE RESISTANCE (minutes)
Add to the fire-resistance rating of wood stud walls if the spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than 2 pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag material wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot.	15

For SI: 1 pound/cubic foot = 16.0185 kg/m<sup>3</sup>.



**FIGURE 722.6.3(1)  
LOAD FIGURE**

$K_e$  = The effective length factor as noted in Figure 722.6.3(2).

$l$  = The unsupported length of columns (inches).

BUCKLING MODES						
THEORETICAL $K_e$ VALUE	0.5	0.7	1.0	1.0	2.0	2.0
RECOMMENDED DESIGN $K_e$ WHEN IDEAL CONDITIONS APPROXIMATED	0.65	0.80	1.2	1.0	2.10	2.4
END CONDITION CODE						

**FIGURE 722.6.3(2)  
EFFECTIVE LENGTH FACTORS**



**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 7A – MATERIALS AND CONSTRUCTION**  
**METHODS FOR EXTERIOR WILDFIRE EXPOSURE**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter		X	X	X																
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter / Section																				



## CHAPTER 7A [SFM]

# MATERIALS AND CONSTRUCTION METHODS FOR EXTERIOR WILDFIRE EXPOSURE

### SECTION 701A SCOPE, PURPOSE AND APPLICATION

**701A.1 Scope.** This chapter applies to building materials, systems and/or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface Fire Area as defined in Section 702A.

**701A.2 Purpose.** The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.

**701A.3 Application.** New buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this chapter.

#### **Exceptions:**

1. Buildings of an accessory character classified as a Group U occupancy and not exceeding 120 square feet in floor area, when located at least 30 feet from an applicable building.
2. Buildings of an accessory character classified as Group U occupancy of any size located least 50 feet from an applicable building.
3. Buildings classified as a Group U Agricultural Building, as defined in Section 202 of this code (see also Appendix C – Group U Agricultural Buildings), when located at least 50 feet from an applicable building.
4. Additions to and remodels of buildings originally constructed prior to the applicable application date.

**701A.3.1 Application date and where required.** New buildings for which an application for a building permit is submitted on or after July 1, 2008 located in any Fire Hazard Severity Zone or Wildland Interface Fire Area shall comply with all sections of this chapter, including all of the following areas:

1. All unincorporated lands designated by the State Board of Forestry and Fire Protection as State Responsibility Area (SRA) including:
  - 1.1. Moderate Fire Hazard Severity Zones
  - 1.2. High Fire Hazard Severity Zones
  - 1.3. Very-High Fire Hazard Severity Zones
2. Land designated as Very-High Fire Hazard Severity Zone by cities and other local agencies.

3. Land designated as Wildland Interface Fire Area by cities and other local agencies.

#### **Exceptions:**

1. New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas, for which an application for a building permit is submitted on or after January 1, 2008, shall comply with all sections of this chapter.
2. New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland Interface Fire Area designated by cities and other local agencies for which an application for a building permit is submitted on or after December 1, 2005 but prior to July 1, 2008, shall only comply with the following sections of this chapter:

2.1. Section 705A – Roofing

2.2. Section 706A – Attic Ventilation

**701A.4 Inspection and certification.** Building permit applications and final completion approvals for buildings within the scope and application of this chapter shall comply with the following:

1. Building permit issuance. The local building official shall, prior to construction, provide the owner or applicant a certification that the building as proposed to be built complies with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a building permit by the local building official for the proposed building shall be considered as complying with this section.
2. Building permit final. The local building official shall, upon completion of construction, provide the owner or applicant with a copy of the final inspection report that demonstrates the building was constructed in compliance with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a certificate of occupancy by the local building official for the proposed building shall be considered as complying with this section.

**701A.5 Vegetation management compliance.** Prior to building permit final approval, the property shall be in compliance with the vegetation management requirements prescribed in California Fire Code Section 4906, including California Public Resources Code 4291 or California Government Code Section 51182. Acceptable methods of compliance inspection

and documentation shall be determined by the enforcing agency and may include any of the following:

1. Local, state or federal fire authority or designee authorized to enforce vegetation management requirements
2. Enforcing agency
3. Third party inspection and certification authorized to enforce vegetation management requirements
4. Property owner certification authorized by the enforcing agency

## SECTION 702A DEFINITIONS

For the purposes of this chapter, certain terms are defined below:

**CDF DIRECTOR** means the Director of the California Department of Forestry and Fire Protection.

**EXTERIOR COVERING.** The exposed siding or cladding material applied to the exterior side of an exterior wall, roof eave soffit, floor projection or exposed underfloor framing.

**FIRE PROTECTION PLAN** is a document prepared for a specific project or development proposed for a Wildland Urban Interface Fire Area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.

The Fire Protection Plan shall be in accordance with this chapter and the California Fire Code, Chapter 49. When required by the enforcing agency for the purposes of granting modifications, a fire protection plan shall be submitted. Only locally adopted ordinances that have been filed with the California Building Standards Commission or the Department of Housing and Community Development in accordance with Section 1.1.8 shall apply.

**FIRE HAZARD SEVERITY ZONES** are geographical areas designated pursuant to California Public Resources Codes Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Areas or as Local Agency Very High Fire Hazard Severity Zones designated pursuant to California Government Code, Sections 51175 through 51189. See California Fire Code Article 86.

The California Code of Regulations, Title 14, Section 1280, entitles the maps of these geographical areas as “Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California.”

**HEAVY TIMBER.** A type of construction classification specified in Section 602. For use in this chapter, heavy timber shall be sawn lumber or glue laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Heavy timber walls or floors shall be sawn or glue-laminated planks splined, tongue-and-groove, or set close together and well spiked.

**IGNITION-RESISTANT MATERIAL.** A type of building material that resists ignition or sustained flaming combustion sufficiently so as to reduce losses from wildland-urban interface conflagrations under worst-case weather and fuel conditions with wildfire exposure of burning embers and small

flames, as prescribed in Section 703A and SFM Standard 12-7A-5, Ignition-Resistant Material.

**LOCAL AGENCY VERY HIGH FIRE HAZARD SEVERITY ZONE** means an area designated by a local agency upon the recommendation of the CDF Director pursuant to Government Code Sections 51177(c), 51178 and 5118 that is not a state responsibility area and where a local agency, city, county, city and county, or district is responsible for fire protection.

**LOG WALL CONSTRUCTION.** A type of construction in which exterior walls are constructed of solid wood members and where the smallest horizontal dimension of each solid wood member is at least 6 inches (152 mm).

**RAFTER TAIL.** The portion of roof rafter framing in a sloping roof assembly that projects beyond and overhangs an exterior wall.

**ROOF EAVE.** The lower portion of a sloping roof assembly that projects beyond and overhangs an exterior wall at the lower end of the rafter tails. Roof eaves may be either “open” or “enclosed.” Open roof eaves have exposed rafter tails and an unenclosed space on the underside of the roof deck. Enclosed roof eaves have a boxed-in roof eave soffit with a horizontal underside or sloping rafter tails with an exterior covering applied to the underside of the rafter tails.

**ROOF EAVE SOFFIT.** An enclosed boxed-in soffit under a roof eave with exterior covering material applied to the soffit framing creating a horizontal surface on the exposed underside.

**STATE RESPONSIBILITY AREA** means lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing forest fires is primarily the responsibility of the state.

**WILDFIRE** is any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property, or resources as defined in Public Resources Code Sections 4103 and 4104.

**WILDFIRE EXPOSURE** is one or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.

**WILDLAND-URBAN INTERFACE FIRE AREA** is a geographical area identified by the state as a “Fire Hazard Severity Zone” in accordance with the Public Resources Code Sections 4201 through 4204 and Government Code Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.

## SECTION 703A STANDARDS OF QUALITY

**703A.1 General.** Building material, systems, assemblies and methods of construction used in this chapter shall be in accordance with Section 703A.

**703A.2 Qualification by testing.** Material and material assemblies tested in accordance with the requirements of



Section 703A shall be accepted for use when the results and conditions of those tests are met. Product evaluation testing of material and material assemblies shall be approved or listed by the State Fire Marshal, or identified in a current report issued by an approved agency.

**703A.3 Approved agency.** Product evaluation testing shall be performed by an approved agency as defined in Section 1702. The scope of accreditation for the approved agency shall include building product compliance with this code.

**703A.4 Labeling.** Material and material assemblies tested in accordance with the requirements of Section 703A shall bear an identification label showing the fire test results. That identification label shall be issued by a testing and/or inspecting agency approved by the State Fire Marshal.

1. Identification mark of the approved testing and/or inspecting agency
2. Contact and identification information of the manufacturer
3. Model number or identification of the product or material
4. Pre-test weathering specified in this chapter
5. Compliance standard as described under Section 703A.7

**703A.5 Weathering and surface treatment protection.**

**703A.5.1 General.** Material and material assemblies tested in accordance with the requirements of Section 703A shall maintain their fire test performance under conditions of use, when installed in accordance with the manufacturers instructions.

**703A.5.2 Weathering.** Fire-retardant-treated wood and fire-retardant-treated wood shingles and shakes shall meet the fire test performance requirements of this chapter after being subjected to the weathering conditions contained in the following standards, as applicable to the materials and the conditions of use.

**703A.5.2.1 Fire-retardant-treated wood.** Fire-retardant-treated wood shall be tested in accordance with ASTM D 2898, "Standard Practice for Accelerated Weathering of Fire-Retardant Treated Wood for Fire Testing (Method A)" and the requirements of Section 2303.2.

**703A.5.2.2 Fire-retardant-treated wood shingles and shakes.** Fire-retardant-treated wood shingles and shakes shall be approved and listed by the State Fire Marshal in accordance with Section 208(c), Title 19 California Code of Regulations.

**703A.5.3 Surface treatment protection.** The use of paints, coatings, stains or other surface treatments are not an approved method of protection as required in this chapter.

**703A.6 Alternates for materials, design, tests and methods of construction.** The enforcing agency is permitted to modify the provisions of this chapter for site-specific conditions in accordance with Section 1.11.2.4. When required by the enforcing agency for the purposes of granting modifications,

a fire protection plan shall be submitted in accordance with the California Fire Code, Chapter 49.

**703A.7 Standards of quality.** The State Fire Marshal standards for exterior wildfire exposure protection listed below and as referenced in this chapter are located in the California Referenced Standards Code, Part 12 and Chapter 35 of this code.

**SFM Standard 12-7A-1, Exterior Wall Siding and Sheathing.** A fire resistance test standard consisting of a 150 kW intensity direct flame exposure for a 10-minute duration.

**SFM Standard 12-7A-2, Exterior Windows.** A fire resistance test standard consisting of a 150 kW intensity direct flame exposure for a 8-minute duration.

**SFM Standard 12-7A-3, Horizontal Projection Underside** A fire resistance test standard consisting of a 300 kW intensity direct flame exposure for a 10-minute duration.

**SFM Standard 12-7A-4, Decking.** A two-part test consisting of a heat release rate (Part A) deck assembly combustion test with an under deck exposure of 80 kW intensity direct flame for a 3-minute duration, and a (Part B) sustained deck assembly combustion test consisting of a deck upper surface burning ember exposure with a 12 mph wind for 40 minutes using a 2.2lb (1kg) burning "Class A" size 12" x 12" x 2.25" (300 mm x 300 mm x 57 mm) roof test brand.

**SFM Standard 12-7A-4A, Decking Alternate Method A.** A heat release rate deck assembly combustion test with an under deck exposure of 80 kW intensity direct flame for a 3-minute duration,

**SFM Standard 12-7A-5, Ignition-resistant Material.** A generic building material surface burning flame spread test standard consisting of an extended 30 minute ASTM E84 or UL 723 test method as is used for fire-retardant-treated wood.

## SECTION 704A IGNITION-RESISTANT CONSTRUCTION

**704A.1 General.** The materials prescribed herein for ignition resistance shall conform to the requirements of this chapter.

**704A.2 Ignition-resistant material.** Ignition-resistant material shall be determined in accordance with the test procedures set forth in SFM Standard 12-7A-5 "Ignition-Resistant Material" or in accordance with this section.

**704A.3 Alternative methods for determining ignition-resistant material.** Any one of the following shall be accepted as meeting the definition of ignition-resistant material:

1. Noncombustible material. Material that complies with the definition for noncombustible materials in Section 202.
2. Fire-retardant-treated wood. Fire-retardant-treated wood identified for exterior use that complies with the requirements of Section 2303.2.
3. Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shingles and shakes, as defined in Section 1505.6 and listed by State Fire Marshal for

use as “Class B” roof covering, shall be accepted as an ignition-resistant wall covering material when installed over solid sheathing.

## SECTION 705A ROOFING

**705A.1 General.** Roofs shall comply with the requirements of Chapter 7A and Chapter 15. Roofs shall have a roofing assembly installed in accordance with its listing and the manufacturer’s installation instructions.

**705A.2 Roof coverings.** Where the roof profile allows a space between the roof covering and roof decking, the spaces shall be constructed to prevent the intrusion of flames and embers, be firestopped with approved materials or have one layer of minimum 72 pound (32.4 kg) mineral-surfaced nonperforated cap sheet complying with ASTM D 3909 installed over the combustible decking.

**705A.3 Roof valleys.** Where valley flashing is installed, the flashing shall be not less than 0.019-inch (0.48 mm) No. 26 gage galvanized sheet corrosion-resistant metal installed over not less than one layer of minimum 72 pound (32.4 kg) mineral-surfaced nonperforated cap sheet complying with ASTM D 3909, at least 36-inch-wide (914 mm) running the full length of the valley.

**705A.4 Roof gutters.** Roof gutters shall be provided with the means to prevent the accumulation of leaves and debris in the gutter.

## SECTION 706A VENTS

**706A.1 General.** Where provided, ventilation openings for enclosed attics, enclosed eave soffit spaces, enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, and underfloor ventilation shall be in accordance with Section 1203 and Sections 706A.1 through 706A.3 to resist building ignition from the intrusion of burning embers and flame through the ventilation openings.

**706A.2 Requirements.** Ventilation openings for enclosed attics, enclosed eave soffit spaces, enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, and underfloor ventilation openings shall be fully covered with metal wire mesh, vents, other materials or other devices that meet the following requirements:

1. The dimensions of the openings therein shall be a minimum of  $\frac{1}{16}$ -inch (1.6 mm) and shall not exceed  $\frac{1}{8}$ -inch (3.2mm).
2. The materials used shall be noncombustible.

**Exception:** Vents located under the roof covering, along the ridge of roofs, with the exposed surface of the vent covered by noncombustible wire mesh, may be of combustible materials.

3. The materials used shall be corrosion resistant.

**706A.3 Ventilation openings on the underside of eaves and cornices.** Vents shall not be installed on the underside of eaves and cornices.

### Exceptions:

1. The enforcing agency may accept or approve special eave and cornice vents that resist the intrusion of flame and burning embers.
2. Vents complying with the requirements of Section 706A.2 may be installed on the underside of eaves and cornices in accordance with either one of the following conditions:
  - 2.1. The attic space being ventilated is fully protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or,
  - 2.2. The exterior wall covering and exposed underside of the eave are of noncombustible material, or ignition-resistant materials as determined in accordance with SFM Standard 12-7A-5 Ignition-Resistant Material and the vent is located more than 12 feet from the ground or walking surface of a deck, porch, patio or similar surface.

## SECTION 707A EXTERIOR COVERING

**707A.1 Scope.** The provisions of this section shall govern the materials and construction methods used to resist building ignition and/or safeguard against the intrusion of flames resulting from small ember and short-term direct flame contact exposure.

**707A.2 General.** The following exterior covering materials and/or assemblies shall comply with this section:

1. Exterior wall covering material
2. Exterior wall assembly
3. Exterior exposed underside of roof eave overhangs
4. Exterior exposed underside of roof eave soffits
5. Exposed underside of exterior porch ceilings
6. Exterior exposed underside of floor projections
7. Exterior underfloor areas

### Exceptions:

1. Exterior wall architectural trim, embellishments, fascias, and gutters
2. Roof or wall top cornice projections and similar assemblies
3. Roof assembly projections over gable end walls
4. Solid wood rafter tails and solid wood blocking installed between rafters having minimum dimension 2 inch (50.8 mm) nominal
5. Deck walking surfaces shall comply with Section 709A.4 only

**707A.3 Exterior walls.** The exterior wall covering or wall assembly shall comply with one of the following requirements:

1. Noncombustible material
2. Ignition-resistant material
3. Heavy timber exterior wall assembly
4. Log wall construction assembly
5. Wall assemblies that meet the performance criteria in accordance with the test procedures for a 10-minute direct flame contact exposure test set forth in SFM Standard 12-7A-1

**Exception:** Any of the following shall be deemed to meet the assembly performance criteria and intent of this section:

1. One layer of  $\frac{5}{8}$ -inch Type X gypsum sheathing applied behind the exterior covering or cladding on the exterior side of the framing
2. The exterior portion of a 1-hour fire resistive exterior wall assembly designed for exterior fire exposure including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual

**707A.3.1 Extent of exterior wall covering.** Exterior wall coverings shall extend from the top of the foundation to the roof, and terminate at 2 inch (50.8 mm) nominal solid wood blocking between rafters at all roof overhangs, or in the case of enclosed eaves, terminate at the enclosure.

**707A.4 Open roof eaves.** The exposed roof deck on the underside of unenclosed roof eaves shall consist of one of the following:

1. Noncombustible material
2. Ignition-resistant material
3. One layer of  $\frac{5}{8}$ -inch Type X gypsum sheathing applied behind an exterior covering on the underside exterior of the roof deck
4. The exterior portion of a 1-hour fire resistive exterior wall assembly applied to the underside of the roof deck designed for exterior fire exposure including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual

**Exceptions:** The following materials do not require protection:

1. Solid wood rafter tails on the exposed underside of open roof eaves having a minimum nominal dimension of 2 inch (50.8 mm)
2. Solid wood blocking installed between rafter tails on the exposed underside of open roof eaves having a minimum nominal dimension of 2 inch (50.8 mm)
3. Gable end overhangs and roof assembly projections beyond an exterior wall other than at the lower end of the rafter tails
4. Fascia and other architectural trim boards

**707A.5 Enclosed roof eaves and roof eave soffits.** The exposed underside of enclosed roof eaves having either a boxed-in roof eave soffit with a horizontal underside, or sloping rafter tails with an exterior covering applied to the underside of the rafter tails, shall be protected by one of the following:

1. Noncombustible material
2. Ignition-resistant material
3. One layer of  $\frac{5}{8}$ -inch Type X gypsum sheathing applied behind an exterior covering on the underside of the rafter tails or soffit
4. The exterior portion of a 1-hour fire resistive exterior wall assembly applied to the underside of the rafter tails or soffit including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual
5. Boxed-in roof eave soffit assemblies with a horizontal underside that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3

**Exceptions:** The following materials do not require protection:

1. Gable end overhangs and roof assembly projections beyond an exterior wall other than at the lower end of the rafter tails
2. Fascia and other architectural trim boards

**707A.6 Exterior porch ceilings.** The exposed underside of exterior porch ceilings shall be protected by one of the following:

1. Noncombustible material
2. Ignition-resistant material
3. One layer of  $\frac{5}{8}$ -inch Type X gypsum sheathing applied behind the exterior covering on the underside of the ceiling
4. The exterior portion of a 1-hour fire resistive exterior wall assembly applied to the underside of the ceiling assembly including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual
5. Porch ceiling assemblies with a horizontal underside that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3

**Exception:** Architectural trim boards.

**707A.7 Floor projections.** The exposed underside of a cantilevered floor projection where a floor assembly extends over an exterior wall shall be protected by one of the following:

1. Noncombustible material
2. Ignition-resistant material
3. One layer of  $\frac{5}{8}$ -inch Type X gypsum sheathing applied behind an exterior covering on the underside of the floor projection
4. The exterior portion of a 1-hour fire resistive exterior wall assembly applied to the underside of the floor projection

jection including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual

5. The underside of a floor projection assembly that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3

**Exception:** Architectural trim boards.

**707A.8 Underfloor protection.** The underfloor area of elevated or overhanging buildings shall be enclosed to grade in accordance with the requirements of this chapter or the underside of the exposed underfloor shall consist of one of the following:

1. Noncombustible material
2. Ignition-resistant material
3. One layer of  $5/8$ -inch Type X gypsum sheathing applied behind an exterior covering on the underside of the floor projection
4. The exterior portion of a 1-hour fire resistive exterior wall assembly applied to the underside of the floor including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual
5. The underside of a floor assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3

**Exception:** Heavy timber structural columns and beams do not require protection.

**707A.8 Underside of appendages.** When required by the enforcing agency the underside of overhanging appendages shall be enclosed to grade in accordance with the requirements of this chapter or the underside of the exposed underfloor shall consist of one of the following:

1. Noncombustible material
2. Ignition-resistant material
3. One layer of  $5/8$ -inch Type X gypsum sheathing applied behind an exterior covering on the underside of the floor projection
4. The exterior portion of a 1-hour fire resistive exterior wall assembly applied to the underside of the floor including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual
5. The underside of a floor assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3

**Exception:** Heavy timber structural columns and beams do not require protection.

## SECTION 708A EXTERIOR WINDOWS AND DOORS

### 708A.1 General.

**708A.2 Exterior glazing.** The following exterior glazing materials and/or assemblies shall comply with this section:

1. Exterior windows
2. Exterior glazed doors
3. Glazed openings within exterior doors
4. Glazed openings within exterior garage doors
5. Exterior structural glass veneer

**708A.2.1 Exterior windows and exterior glazed door assembly requirements.** Exterior windows and exterior glazed door assemblies shall comply with one of the following requirements:

1. Be constructed of multipane glazing with a minimum of one tempered pane meeting the requirements of Section 2406 Safety Glazing, or
2. Be constructed of glass block units, or
3. Have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 257, or
4. Be tested to meet the performance requirements of SFM Standard 12-7A-2

**708A.2.2 Structural glass veneer.** The wall assembly behind structural glass veneer shall comply with Section 707A.3.

**708A.3 Exterior doors.** Exterior doors shall comply with one of the following:

1. The exterior surface or cladding shall be of noncombustible or ignition-resistant material, or
2. Shall be constructed of solid core wood that comply with the following requirements:
  - 2.1. Stiles and rails shall not be less than  $1\frac{3}{8}$  inches thick.
  - 2.2. Raised panels shall not be less than  $1\frac{1}{4}$  inches thick, except for the exterior perimeter of the raised panel that may taper to a tongue not less than  $\frac{3}{8}$  inch thick.
3. Shall have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 252.
4. Shall be tested to meet the performance requirements of SFM Standard 12-7A-1.

**708A.3.1 Exterior door glazing.** Glazing in exterior doors shall comply with Section 708A.2.1.

## SECTION 709A DECKING

**709A.1 General.** The walking surface material of decks, porches, balconies and stairs shall comply with the requirements of this section.

**709A.2 Where required.** The walking surface material of decks, porches, balconies and stairs shall comply with the requirements of this section when any portion of such surface is within 10 feet (3048 mm) of the building.

**709A.3 Decking Surfaces.** The walking surface material of decks, porches, balconies and stairs shall be constructed with one of the following materials:

1. Ignition-resistant material that complies with the performance requirements of both SFM Standard 12-7A-4 and SFM Standard 12-7A-5.
2. Exterior fire retardant treated wood
3. Noncombustible material
4. Any material that complies with the performance requirements of SFM Standard 12-7A-4A when attached exterior wall covering is also either noncombustible or ignition-resistant material.

**Exception:** Wall material may be of any material that otherwise complies with this chapter when the decking surface material complies with the performance requirements ASTM E 84 with a Class B flame spread rating.

## SECTION 710A ACCESSORY STRUCTURES

**710A.1 General.** Accessory and miscellaneous structures, other than buildings covered by Section 701A.3, which pose a significant exterior exposure hazard to applicable buildings during wildfires shall be constructed to conform to the ignition resistance requirements of this section.

**710A.2 Applicability.** The provisions of this section shall apply to trellises, arbors, patio covers, carports, gazebos and similar structures of an accessory or miscellaneous character.

**Exceptions:**

1. Decks shall comply with the requirements of Section 709A.
2. Awnings and canopies shall comply with the requirements of Section 3105.

**710A.3 Where required.** Accessory structures shall comply with the requirements of this section.

**710A.3.1** Attached accessory structures shall comply with the requirements of this section.

**710A.3.2** When required by the enforcing agency, detached accessory structures within 50 feet of an applicable building shall comply with the requirements of this section.

**710A.4 Requirements.** When required by the enforcing agency accessory structures shall be constructed of noncombustible or ignition-resistant materials.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 8 – INTERIOR FINISHES

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X		X	X			X	X	X	X		X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X																		
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
Table 803.9		X																		
804.4		X																		
804.4.1		X																		
804.4.2		X																		
804.4.3		X																		
806.5		X																		





## CHAPTER 8

# INTERIOR FINISHES

### SECTION 801 GENERAL

**801.1 Scope.** Provisions of this chapter shall govern the use of materials used as interior finishes, trim and decorative materials.

**801.2 Interior wall and ceiling finish.** The provisions of Section 803 shall limit the allowable fire performance and smoke development of interior wall and ceiling finish materials based on occupancy classification.

**801.3 Interior floor finish.** The provisions of Section 804 shall limit the allowable fire performance of interior floor finish materials based on occupancy classification.

**[F] 801.4 Decorative materials and trim.** Decorative materials and trim shall be restricted by combustibility and the flame propagation performance criteria of NFPA 701, in accordance with Section 806.

**801.5 Applicability.** For buildings in flood hazard areas as established in Section 1612.3, interior finishes, trim and decorative materials below the elevation required by Section 1612 shall be flood-damage-resistant materials.

**801.6 Application.** Combustible materials shall be permitted to be used as finish for walls, ceilings, floors and other interior surfaces of buildings.

**801.7 Windows.** Show windows in the exterior walls of the first story above grade plane shall be permitted to be of wood or of unprotected metal framing.

**801.8 Foam plastics.** Foam plastics shall not be used as interior finish except as provided in Section 803.4. Foam plastics shall not be used as interior trim except as provided in Section 806.3 or 2604.2. This section shall apply both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or cover.

### SECTION 802 DEFINITIONS

**802.1 Definitions.** The following terms are defined in Chapter 2:

**EXPANDED VINYL WALL COVERING.**

**FLAME SPREAD.**

**FLAME SPREAD INDEX.**

**INTERIOR FINISH.**

**INTERIOR FLOOR FINISH.**

**INTERIOR FLOOR-WALL BASE.**

**INTERIOR WALL AND CEILING FINISH.**

**SITE-FABRICATED STRETCH SYSTEM.**

**SMOKE-DEVELOPED INDEX.**

**TRIM.**

### SECTION 803 WALL AND CEILING FINISHES

**803.1 General.** Interior wall and ceiling finish materials shall be classified for fire performance and smoke development in accordance with Section 803.1.1 or 803.1.2, except as shown in Sections 803.2 through 803.13. Materials tested in accordance with Section 803.1.2 shall not be required to be tested in accordance with Section 803.1.1.

**803.1.1 Interior wall and ceiling finish materials.** Interior wall and ceiling finish materials shall be classified in accordance with ASTM E 84 or UL 723. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indexes.

Class A: = Flame spread index 0-25; smoke-developed index 0-450.

Class B: = Flame spread index 26-75; smoke-developed index 0-450.

Class C: = Flame spread index 76-200; smoke-developed index 0-450.

**Exception:** Materials tested in accordance with Section 803.1.2.

**803.1.2 Room corner test for interior wall or ceiling finish materials.** Interior wall or ceiling finish materials shall be permitted to be tested in accordance with NFPA 286. Interior wall or ceiling finish materials tested in accordance with NFPA 286 shall comply with Section 803.1.2.1.

**803.1.2.1 Acceptance criteria for NFPA 286.** The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m<sup>2</sup>.

**803.1.3 Room corner test for textile wall coverings and expanded vinyl wall coverings.** Textile wall coverings and expanded vinyl wall coverings shall meet the criteria of Section 803.1.3.1 when tested in the manner intended for use in accordance with the Method B protocol of NFPA 265 using the product-mounting system, including adhesive.

**803.1.3.1 Acceptance criteria for NFPA 265.** The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 by 305 mm) walls.
3. Flashover, as defined in NFPA 265, shall not occur.
4. The total smoke released throughout the test shall not exceed 1,000 m<sup>2</sup>.

**803.1.4 Acceptance criteria for textile and expanded vinyl wall or ceiling coverings tested to ASTM E 84 or UL 723.** Textile wall and ceiling coverings and expanded vinyl wall and ceiling coverings shall have a Class A flame spread index in accordance with ASTM E 84 or UL 723 and be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. Test specimen preparation and mounting shall be in accordance with ASTM E 2404.

**803.2 Thickness exemption.** Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls or ceilings shall not be required to be tested.

**803.3 Heavy timber exemption.** Exposed portions of structural members complying with the requirements for buildings of Type IV construction in Section 602.4 shall not be subject to interior finish requirements.

**803.4 Foam plastics.** Foam plastics shall not be used as interior finish except as provided in Section 2603.10. This section shall apply both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or cover.

**803.5 Textile wall coverings.** Where used as interior wall finish materials, textile wall coverings, including materials having woven or nonwoven, napped, tufted, looped or similar surface and carpet and similar textile materials, shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.2, 803.1.3 or 803.1.4.

**803.6 Textile ceiling coverings.** Where used as interior ceiling finish materials, textile ceiling coverings, including materials having woven or nonwoven, napped, tufted, looped or similar surface and carpet and similar textile materials, shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.2 or 803.1.4.

**803.7 Expanded vinyl wall coverings.** Where used as interior wall finish materials, expanded vinyl wall coverings shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.2, 803.1.3 or 803.1.4.

**803.8 Expanded vinyl ceiling coverings.** Where used as interior ceiling finish materials, expanded vinyl ceiling coverings shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.2 or 803.1.4.

**803.9 Interior finish requirements based on group.** Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.9 for the group and location designated. Interior wall and ceiling finish materials tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.2.1, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 or UL 723 is required.

**803.10 Stability.** Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

**803.11 Application of interior finish materials to fire-resistance-rated or noncombustible building elements.** Where interior finish materials are applied on walls, ceilings or structural elements required to have a fire-resistance rating or to be of noncombustible construction, they shall comply with the provisions of this section.

**803.11.1 Direct attachment and furred construction.** Where walls and ceilings are required by any provision in this code to be of fire-resistance-rated or noncombustible construction, the interior finish material shall be applied directly against such construction or to furring strips not exceeding 1<sup>3</sup>/<sub>4</sub> inches (44 mm), applied directly against such surfaces.

**803.11.1.1 Furred construction.** If the interior finish material is applied to furring strips, the intervening spaces between such furring strips shall comply with one of the following:

1. Be filled with material that is inorganic or noncombustible;
2. Be filled with material that meets the requirements of a Class A material in accordance with Section 803.1.1 or 803.1.2; or
3. Be fireblocked at a maximum of 8 feet (2438 mm) in every direction in accordance with Section 718.

**803.11.2 Set-out construction.** Where walls and ceilings are required to be of fire-resistance-rated or noncombustible construction and walls are set out or ceilings are dropped distances greater than specified in Section 803.11.1, Class A finish materials, in accordance with Section 803.1.1 or 803.1.2, shall be used.

**Exceptions:**

1. Where interior finish materials are protected on both sides by an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Where interior finish materials are attached to noncombustible backing or furring strips installed as specified in Section 803.11.1.1.

**803.11.2.1 Hangers and assembly members.** The hangers and assembly members of such dropped ceilings that are below the horizontal fire-resistance rated floor or roof assemblies shall be of noncombustible materials. The construction of each set-out wall and

**TABLE 803.9**  
**INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY<sup>k</sup>**

GROUP	SPRINKLERED <sup>l</sup>			NONSPRINKLERED		
	Interior exit stairways, interior exit ramps and exit passageways <sup>a,b</sup>	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces <sup>c</sup>	Interior exit stairways, interior exit ramps and exit passageways <sup>a,b</sup>	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces <sup>c</sup>
A-1 & A-2	B	B	C	A	A <sup>d</sup>	B <sup>e</sup>
A-3 <sup>f</sup> , A-4, A-5	B	B	C	A	A <sup>d</sup>	C
B, E, M, R-1	B	C	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H, L	B	B	C <sup>g</sup>	A	A	B
I-2, I-2.1	B	B	B <sup>h,i</sup>	A	A	B
I-3	A	A <sup>j</sup>	B	NP	NP	NP
I-4	B	B	B <sup>h,i</sup>	A	A	B
R-2	C	C	C	B	B	C
R-2.1	B	C	C	A	B	B
R-3, R-3.1	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929m<sup>2</sup>.

NP = Not permitted [SFM]

- Class C interior finish materials shall be permitted for wainscoting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.11.1.
- In other than Group I-2 occupancies in buildings less than three stories above grade plane of other than Group I-3, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.
- Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and the rooms or spaces on both sides shall be considered one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.
- Lobby areas in Group A-1, A-2 and A-3 occupancies shall not be less than Class B materials.
- Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.
- For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.
- Class B material is required where the building exceeds two stories.
- Class C interior finish materials shall be permitted in administrative spaces.
- Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.
- Class B materials shall be permitted as wainscoting extending not more than 48 inches above the finished floor in corridors and exit access stairways and ramps.
- Finish materials as provided for in other sections of this code.
- Applies when protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

horizontal fire-resistance rated floor or roof assembly shall be of fire-resistance-rated construction as required elsewhere in this code.

**Exception:** In Types III and V construction, fire-retardant-treated wood shall be permitted for use as hangers and assembly members of dropped ceilings.

**803.11.3 Heavy timber construction.** Wall and ceiling finishes of all classes as permitted in this chapter that are installed directly against the wood decking or planking of Type IV construction or to wood furring strips applied directly to the wood decking or planking shall be fire-blocked as specified in Section 803.11.1.1.

**803.11.4 Materials.** An interior wall or ceiling finish material that is not more than 1/4 inch (6.4 mm) thick shall be applied directly onto the wall, ceiling or structural ele-

ment without the use of furring strips and shall not be suspended away from the building element to which it is applied.

**Exceptions:**

- Noncombustible interior finish materials.
- Materials that meet the requirements of Class A materials in accordance with Section 803.1.1 or 803.1.2 where the qualifying tests were made with the material furred out from the noncombustible backing shall be permitted to be used with furring strips.
- Materials that meet the requirements of Class A materials in accordance with Section 803.1.1 or 803.1.2 where the qualifying tests were made with the material suspended away from the non-

combustible backing shall be permitted to be used suspended away from the building element.

**803.12 High-density Polyethylene (HDPE) and Polypropylene (PP).** Where high-density polyethylene or polypropylene is used as an interior finish it shall comply with Section 803.1.2.

**803.13 Site-fabricated stretch systems.** Where used as interior wall or interior ceiling finish materials, site-fabricated stretch systems containing all three components described in the definition in Section 802 shall be tested in the manner intended for use, and shall comply with the requirements of Section 803.1.1 or 803.1.2. If the materials are tested in accordance with ASTM E 84 or UL 723, specimen preparation and mounting shall be in accordance with ASTM E 2573.

## SECTION 804 INTERIOR FLOOR FINISH

**804.1 General.** Interior floor finish and floor covering materials shall comply with Sections 804.2 through 804.4.2.

**Exception:** Floor finishes and coverings of a traditional type, such as wood, vinyl, linoleum or terrazzo, and resilient floor covering materials that are not comprised of fibers.

**804.2 Classification.** Interior floor finish and floor covering materials required by Section 804.4.2 to be of Class I or II materials shall be classified in accordance with NFPA 253. The classification referred to herein corresponds to the classifications determined by NFPA 253 as follows: Class I, 0.45 watts/cm<sup>2</sup> or greater; Class II, 0.22 watts/cm<sup>2</sup> or greater.

**804.3 Testing and identification.** Interior floor finish and floor covering materials shall be tested by an agency in accordance with NFPA 253 and identified by a hang tag or other suitable method so as to identify the manufacturer or supplier and style, and shall indicate the interior floor finish or floor covering classification according to Section 804.2. Carpet-type floor coverings shall be tested as proposed for use, including underlayment. Test reports confirming the information provided in the manufacturer's product identification shall be furnished to the building official upon request.

**804.4 Interior floor finish requirements.** Interior floor covering materials shall comply with Sections 804.4.1 and 804.4.2 and interior floor finish materials shall comply with Section 804.4.3.

**804.4.1 Test requirement.** In all *other* occupancies except I-3, interior floor finish and interior floor covering materials shall comply with the requirements of the *ASTM Standard E 648*, and having a specific optical density smoke rating not to exceed 450 per ASTM E 662. For Group I-3 occupancies see Section 804.4.3.

**804.4.2 Minimum critical radiant flux.** In all occupancies, interior floor finish and floor covering materials in enclosures for stairways and ramps, exit passageways, corridors and rooms or spaces not separated from corridors by partitions extending from the floor to the underside of the ceiling shall withstand a minimum critical radiant flux. The minimum critical radiant flux shall not be less than

Class I in Groups I-2 and not less than Class II in Groups A, B, E, H, I-4, M, R-1, R-2 and S.

**Exception:** Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, Class II materials are permitted in any area where Class I materials are required, and materials complying with *ASTM Standard E 648*, and having a specific optical density smoke rating not to exceed 450 per ASTM E 662 are permitted in any area where Class II materials are required.

**804.4.3 Group I-3 Occupancy floor surfaces.** Interior floor finish and floor coverings occupied by inmates or patients whose personal liberties are restrained shall be noncombustible.

**Exception:** Noncombustible floor finish and floor coverings in areas where restraint is not used may have carpet or other floor covering materials applied in areas protected by an automatic sprinkler system and meeting ASTM Standard E 648, and having a specific optical density smoke rating not to exceed 450 per ASTM E 662. The carpeting and carpet padding shall be tested as a unit in accordance with floor covering radiant panel test meeting class I and has a critical radiant flux limit of not less than 0.45 watt per centimeter square. The carpeting and padding shall be identified by a hang-tag or other suitable method as to manufacturer and style and shall indicate the classification of the material based on the limits set forth above.

## SECTION 805 COMBUSTIBLE MATERIALS IN TYPES I AND II CONSTRUCTION

**805.1 Application.** Combustible materials installed on or embedded in floors of buildings of Type I or II construction shall comply with Sections 805.1.1 through 805.1.3.

**Exception:** Stages and platforms constructed in accordance with Sections 410.3 and 410.4, respectively.

**805.1.1 Subfloor construction.** Floor sleepers, bucks and nailing blocks shall not be constructed of combustible materials, unless the space between the fire-resistance-rated floor assembly and the flooring is either solidly filled with noncombustible materials or fireblocked in accordance with Section 718, and provided that such open spaces shall not extend under or through permanent partitions or walls.

**805.1.2 Wood finish flooring.** Wood finish flooring is permitted to be attached directly to the embedded or fire-blocked wood sleepers and shall be permitted where cemented directly to the top surface of fire-resistance-rated floor assemblies or directly to a wood subfloor attached to sleepers as provided for in Section 805.1.1.

**805.1.3 Insulating boards.** Combustible insulating boards not more than 1/2 inch (12.7 mm) thick and covered with finish flooring are permitted where attached directly to a noncombustible floor assembly or to wood subflooring attached to sleepers as provided for in Section 805.1.1.

## SECTION 806 DECORATIVE MATERIALS AND TRIM

**[F] 806.1 General requirements.** In occupancies in Groups A, E, I and R-1 and dormitories in Group R-2, curtains, draperies, hangings and other decorative materials suspended from walls or ceilings shall meet the flame propagation performance criteria of NFPA 701 in accordance with Section 806.2 or be noncombustible.

### Exceptions:

1. Curtains, draperies, hangings and other decorative materials suspended from walls of sleeping units and dwelling units in dormitories in Group R-2 protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1 and such materials are limited to not more than 50 percent of the aggregate area of walls.
2. Decorative materials, including, but not limited to, photographs and paintings in dormitories in Group R-2 where such materials are of limited quantities such that a hazard of fire development or spread is not present.

In Groups I-1 and I-2, combustible decorative materials shall meet the flame propagation criteria of NFPA 701 unless the decorative materials, including, but not limited to, photographs and paintings, are of such limited quantities that a hazard of fire development or spread is not present. In Group I-3, combustible decorative materials are prohibited.

Fixed or movable walls and partitions, paneling, wall pads and crash pads applied structurally or for decoration, acoustical correction, surface insulation or other purposes shall be considered interior finish if they cover 10 percent or more of the wall or of the ceiling area, and shall not be considered decorative materials or furnishings.

In Group B and M occupancies, fabric partitions suspended from the ceiling and not supported by the floor shall meet the flame propagation performance criteria in accordance with Section 806.2 and NFPA 701 or shall be noncombustible.

**[F] 806.1.1 Noncombustible materials.** The permissible amount of noncombustible decorative material shall not be limited.

**[F] 806.1.2 Combustible decorative materials.** The permissible amount of decorative materials meeting the flame propagation performance criteria of NFPA 701 shall not exceed 10 percent of the specific wall or ceiling area to which it is attached.

### Exceptions:

1. In auditoriums in Group A, the permissible amount of decorative material meeting the flame propagation performance criteria of NFPA 701 shall not exceed 75 percent of the aggregate wall area where the building is equipped throughout with an automatic sprinkler system in accordance

with Section 903.3.1.1 and where the material is installed in accordance with Section 803.11.

2. The amount of fabric partitions suspended from the ceiling and not supported by the floor in Group B and M occupancies shall not be limited.

**[F] 806.2 Acceptance criteria and reports.** Where required by Section 806.1, decorative materials shall be tested by an agency and meet the flame propagation performance criteria of NFPA 701 or such materials shall be noncombustible. Reports of test results shall be prepared in accordance with NFPA 701 and furnished to the building official upon request.

**[F] 806.3 Foam plastic.** Foam plastic used as trim in any occupancy shall comply with Section 2604.2.

**[F] 806.4 Pyroxylin plastic.** Imitation leather or other material consisting of or coated with a pyroxylin or similarly hazardous base shall not be used in Group A occupancies.

**[F] 806.5 Interior trim.** Material, other than foam plastic used as interior trim, shall have a minimum *Class B flame spread and 450 smoke-developed index in Group I-3 and for all other occupancies* Class C flame spread and smoke-developed index when tested in accordance with ASTM E 84 or UL 723, as described in Section 803.1.1. Combustible trim, excluding handrails and guardrails, shall not exceed 10 percent of the specific wall or ceiling area in which it is attached.

**[F] 806.6 Interior floor-wall base.** Interior floor-wall base that is 6 inches (152 mm) or less in height shall be tested in accordance with Section 804.2 and shall not be less than Class II. Where a Class I floor finish is required, the floor-wall base shall be Class I.

**Exception:** Interior trim materials that comply with Section 806.5.

## SECTION 807 INSULATION

**807.1 Insulation.** Thermal and acoustical insulation shall comply with Section 720.

## SECTION 808 ACOUSTICAL CEILING SYSTEMS

**808.1 Acoustical ceiling systems.** The quality, design, fabrication and erection of metal suspension systems for acoustical tile and lay-in panel ceilings in buildings or structures shall conform with generally accepted engineering practice, the provisions of this chapter and other applicable requirements of this code.

**808.1.1 Materials and installation.** Acoustical materials complying with the interior finish requirements of Section 803 shall be installed in accordance with the manufacturer's recommendations and applicable provisions for applying interior finish.

**808.1.1.1 Suspended acoustical ceilings.** Suspended acoustical ceiling systems shall be installed in accordance with the provisions of ASTM C 635 and ASTM C 636.

**808.1.1.2 Fire-resistance-rated construction.** Acoustical ceiling systems that are part of fire-resistance-rated construction shall be installed in the same manner used in the assembly tested and shall comply with the provisions of Chapter 7.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 9 – FIRE PROTECTION SYSTEMS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X													X	
Chapter / Section																				
901.2		X																		
901.3		X																		
901.5		X																		
901.6.2		X																		
902.1		X																		
Fire Appliance		X																		
Sprinkler Alarm		X																	X	
Sprinkler System		X																	X	
Standpipe System, Classes of.		X																	X	
> 903.2.1.2		X																		
903.2.1.3		X																		
> 903.2.3		X																		
903.2.4.1		X																		
903.2.5.4		X																		
903.2.6		X																		
903.2.6.1		X																		
903.2.6.2		X																		
903.2.6.3		X																		
903.2.7		X																		
903.2.7.1		X																		
903.2.8		X																		
903.2.10		X																		
> Table 903.2.11.6		X																		
903.2.14		X																		
903.2.14.1		X																		
903.2.14.2		X																		
903.2.15		X																		
903.2.15.1		X																		
903.2.16		X																		
903.2.16.1		X																		
903.2.17		X																		
903.2.17.1		X																		
903.2.17.2		X																		
903.2.17.2.1		X																		
903.2.17.2.2		X																		
903.2.17.2.3		X																		
903.2.17.2.4		X																		
903.2.17.2.5		X																		
903.2.17.2.6		X																		
903.2.18		X																		
903.2.19		X																		

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# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 9 – FIRE PROTECTION SYSTEMS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X													X	
Chapter / Section																				
903.1.3		X																		
903.2		X																		
903.2.7		X																		
903.2.7.1		X																		
903.2.8		X																		
903.2.8.1		X																		
903.2.10		X																		
903.2.11.4		X																		
Table 903.2.11.6		X																		
903.2.12		X																		
903.2.14		X																		
903.2.14.1		X																		
903.2.14.2		X																		
903.2.15		X																		
903.2.15.1		X																		
903.2.16		X																		
903.2.16.1		X																		
903.2.17		X																		
903.2.18		X																		
903.2.19		X																		
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903.2.19.1.2		X																		
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903.3.1.2		X																		
903.3.2		X																		
903.3.5		X																		
903.3.5.2		X																		
903.3.7		X																		
903.3.8		X																		
903.4.2		X																		
903.4.3		X																		
903.5		X																		
904.2.1		X																		
904.3.1		X																		
904.5		X																		
904.6		X																		
904.7		X																		
904.8		X																		
904.9		X																		
904.10		X																		

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# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 9 – FIRE PROTECTION SYSTEMS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X	X	X		X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X																
<i>Adopt only those sections that are listed below</i>						X													X	
<i>Chapter / Section</i>																				
904.11		X																		
905.1		X																		
905.3		X																		
905.3.1		X																		
905.3.6		X																		
905.3.8		X																		
905.3.9		X																		
905.3.10		X																		
905.3.11		X																		
905.3.11.1		X																		
905.4		X																		
905.5		X																		
906.1		X																		
906.2		X																		
Table 906.3(1)		X																		
906.3.2		X																		
Table 906.3(2)		X																		
906.3.4		X																		
907.1.2		X																		
907.1.3		X																		
907.1.4		X																		
907.1.5		X																		
907.2		X																		
907.2.1		X																		
907.2.1.1		X																		
907.2.1.3		X																		
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907.2.3		X																		
907.2.3.1		X																		
907.2.3.2		X																		
907.2.3.3		X																		
907.2.3.4		X																		
907.2.3.5		X																		
907.2.3.6		X																		
907.2.3.6.1		X																		
907.2.3.6.2		X																		
907.2.3.7		X																		
907.2.3.8		X																		

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 9 – FIRE PROTECTION SYSTEMS—continued**

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X	X	X		X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X																
<i>Adopt only those sections that are listed below</i>						X													X	
<i>Chapter / Section</i>																				
907.2.3.8.1		X																		
907.2.3.8.2		X																		
907.2.5		X																		
907.2.5.1		X																		
907.2.6		X																		
907.2.6.2		X																		
907.2.6.2.1		X																		
907.2.6.2.2		X																		
907.2.6.3		X																		
907.2.6.3.3		X																		
907.2.6.3.4		X																		
907.2.6.4		X																		
907.2.8		X																		
907.2.9		X																		
907.2.9.1		X																		
907.2.9.3		X																		
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907.2.11.2		X																		
907.2.11.2.1		X																		
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907.2.11.3		X																		
907.2.11.4		X																		
907.2.11.5		X																		
907.2.11.6		X																		
907.2.13		X																		
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907.2.13.1.1		X																		
907.2.13.1.2		X																		
907.2.13.2		X																		
907.2.15		X																		
907.2.16		X																		
907.2.24		X																		
907.2.24.1		X																		
907.2.24.2		X																		
907.2.24.3		X																		
907.2.24.4		X																		

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 9 – FIRE PROTECTION SYSTEMS—continued**

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X													X	
Chapter / Section																				
907.2.24.4.1		X																		
907.2.24.4.2		X																		
907.2.24.4.3		X																		
907.2.25		X																		
907.2.25.1		X																		
907.2.25.2		X																		
907.2.26		X																		
907.2.26.1		X																		
907.2.26.2		X																		
907.2.26.3		X																		
907.2.26.4		X																		
907.2.26.4.1		X																		
907.2.26.4.2		X																		
907.2.27		X																		
907.2.28		X																		
907.2.28.1		X																		
907.2.29		X																		
907.2.29.1		X																		
907.2.29.2		X																		
907.2.29.3		X																		
907.2.29.4		X																		
907.3		X																		
907.3.1		X																		
907.3.2		X																		
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907.3.2.3		X																		
907.4.1		X																		
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907.4.2.2						X														
907.4.2.5		X																		
907.4.2.7		X																		
907.5.2.1		X																		
907.5.2.1.1		X																		
907.5.2.1.3		X																		
907.5.2.2		X																		
907.5.2.3		X				X														
907.5.2.3.1		X				X														
907.5.2.3.2						X														
907.5.2.3.3		X				X														
Table 907.5.2.3.3		X				X														

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# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 9 – FIRE PROTECTION SYSTEMS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X	X	X		X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X																
Adopt only those sections that are listed below						X													X	
Chapter / Section																				
907.5.2.3.4		X	X	X	X	X														
907.5.2.3.5		X				X														
907.5.2.4		X																		
907.5.2.5		X																		
907.6.1		X																		
907.6.1.1		X																		
907.6.3		X																		
907.6.3.1.1		X																		
907.6.3.2		X																		
907.6.3.3		X																		
907.6.3.4		X																		
907.6.5		X																		
907.6.5.2		X																		
907.6.5.3		X																		
907.7		X																		
907.8		X																		
908.6		X																		
908.7			†	†																
909.1		X																		
909.5.2		X																		
909.8		X																		
909.10.2		X																		
909.12		X																		
909.12.1		X																		
909.13.1			X	X																
909.16		X																		
909.16.3		X																		
909.18.9		X																		
909.20.1		X																		
909.20.2.1		X																		
909.20.2.2		X																		
909.20.2.3		X																		
909.20.2.4		X																		
909.20.2.5		X																		

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 9 – FIRE PROTECTION SYSTEMS—continued**

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X	X	X		X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X																
<i>Adopt only those sections that are listed below</i>						X													X	
<i>Chapter / Section</i>																				
909.20.3		X																		
909.20.3.1		X																		
909.20.3.2		X																		
909.20.4		X																		
909.20.4.1		X																		
909.20.4.2		X																		
909.20.4.3		X																		
909.20.4.3.1		X																		
909.20.4.3.2		X																		
909.20.4.3.3		X																		
909.20.5		X																		
909.20.5.1		X																		
909.20.5.2		X																		
909.20.5.3		X																		
910.1		X																		
910.3.1		X																		
910.3.2.2		X																		
910.3.2.2.1		X																		
910.3.2.2.2		X																		
910.3.2.2.3		X																		
910.4		X																		
910.4.1		X																		
910.4.2		X																		
911.1		X																		
911.1.5		X																		
912.3		X																		
912.5		X																		
913.6		X																		

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 9

# FIRE PROTECTION SYSTEMS

### SECTION 901 GENERAL

**901.1 Scope.** The provisions of this chapter shall specify where fire protection systems are required and shall apply to the design, installation and operation of fire protection systems.

**901.2 Fire protection systems.** Fire protection systems shall be installed, repaired, operated and maintained in accordance with this code and the *California Fire Code*.

Any fire protection system for which an exception or reduction to the provisions of this code has been granted shall be considered to be a required system.

**Exception:** Any fire protection system or portion thereof not required by this code shall be permitted to be installed for partial or complete protection provided that such system meets the requirements of this code.

**901.3 Modifications.** No person shall remove or modify any fire protection system installed or maintained under the provisions of this code or the *California Fire Code* without approval by the building official.

**901.4 Threads.** Threads provided for fire department connections to sprinkler systems, standpipes, yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department.

**901.5 Acceptance tests.** Fire protection systems shall be tested in accordance with the requirements of this code and the *California Fire Code*. When required, the tests shall be conducted in the presence of the building official. Tests required by this code, the *California Fire Code* and the standards listed in this code shall be conducted at the expense of the owner or the owner's representative. It shall be unlawful to occupy portions of a structure until the required fire protection systems within that portion of the structure have been tested and approved.

**901.6 Supervisory service.** Where required, fire protection systems shall be monitored by an approved supervising station in accordance with NFPA 72.

**901.6.1 Automatic sprinkler systems.** Automatic sprinkler systems shall be monitored by an approved supervising station.

#### Exceptions:

1. A supervising station is not required for automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area systems serving fewer than 20 sprinklers.

**901.6.2 Fire alarm systems.** Fire alarm systems required by the provisions of Section 907.2 of this code and Sections 907.2 and 907.9 of the *California Fire Code* shall be

monitored by an approved supervising station in accordance with Section 907.6.5.

#### Exceptions:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies.
3. Supervisory service is not required for automatic sprinkler systems in one- and two-family dwellings.

**901.6.3 Group H.** Supervision and monitoring of emergency alarm, detection and automatic fire-extinguishing systems in Group H occupancies shall be in accordance with the *California Fire Code*.

**901.7 Fire areas.** Where buildings, or portions thereof, are divided into fire areas so as not to exceed the limits established for requiring a fire protection system in accordance with this chapter, such fire areas shall be separated by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, having a fire-resistance rating of not less than that determined in accordance with Section 707.3.10.

**[F] 901.8 Pump and riser room size.** Fire pump and automatic sprinkler system riser rooms shall be designed with adequate space for all equipment necessary for the installation, as defined by the manufacturer, with sufficient working room around the stationary equipment. Clearances around equipment to elements of permanent construction, including other installed equipment and appliances, shall be sufficient to allow inspection, service, repair or replacement without removing such elements of permanent construction or disabling the function of a required fire-resistance-rated assembly. Fire pump and automatic sprinkler system riser rooms shall be provided with a door(s) and unobstructed passageway large enough to allow removal of the largest piece of equipment.

### SECTION 902 DEFINITIONS

**902.1 Definitions.** The following terms are defined in Chapter 2:

**[F] ALARM NOTIFICATION APPLIANCE.**

**[F] ALARM SIGNAL.**

**[F] ALARM VERIFICATION FEATURE.**

**[F] ANNUNCIATOR.**

**[F] AUDIBLE ALARM NOTIFICATION APPLIANCE.**

**[F] AUTOMATIC.**

**[F] AUTOMATIC FIRE-EXTINGUISHING SYSTEM.**

**[F] AUTOMATIC SMOKE DETECTION SYSTEM.**

[F] AUTOMATIC SPRINKLER SYSTEM.  
 [F] AVERAGE AMBIENT SOUND LEVEL.  
 [F] CARBON DIOXIDE EXTINGUISHING SYSTEMS.  
 [F] CEILING LIMIT.  
 [F] CLEAN AGENT.  
 [F] CONSTANTLY ATTENDED LOCATION.  
 [F] DELUGE SYSTEM.  
 [F] DETECTOR, HEAT.  
 [F] DRY-CHEMICAL EXTINGUISHING AGENT.  
 [F] ELEVATOR GROUP.  
 [F] EMERGENCY ALARM SYSTEM.  
 [F] EMERGENCY VOICE/ALARM COMMUNICATIONS.  
 [F] FIRE ALARM BOX, MANUAL.  
 [F] FIRE ALARM CONTROL UNIT.  
 [F] FIRE ALARM SIGNAL.  
 [F] FIRE ALARM SYSTEM.

|| **FIRE APPLIANCE**

**FIRE AREA.**  
 [F] FIRE COMMAND CENTER.  
 [F] FIRE DETECTOR, AUTOMATIC.  
 [F] FIRE PROTECTION SYSTEM.  
 [F] FIRE SAFETY FUNCTIONS.  
 [F] FOAM-EXTINGUISHING SYSTEM.  
 [F] HALOGENATED EXTINGUISHING SYSTEM.  
 [F] INITIATING DEVICE.  
 [F] MANUAL FIRE ALARM BOX.  
 [F] MULTIPLE-STATION ALARM DEVICE.  
 [F] MULTIPLE-STATION SMOKE ALARM.  
 [F] NOTIFICATION ZONE.  
 [F] NUISANCE ALARM.  
 [F] RECORD DRAWINGS.  
 [F] SINGLE-STATION SMOKE ALARM.  
 [F] SMOKE ALARM.  
 [F] SMOKE DETECTOR.  
 [F] SMOKEPROOF ENCLOSURE.  
 [F] STANDPIPE SYSTEM, CLASSES OF.

Class I system.

Class II system.

Class III system.

[F] STANDPIPE, TYPES OF.

Automatic dry.

Automatic wet.

Manual dry.

Manual wet.

Semiautomatic dry.

[F] SUPERVISING STATION.

[F] SUPERVISORY SERVICE.

[F] SUPERVISORY SIGNAL.

[F] SUPERVISORY SIGNAL-INITIATING DEVICE.

[F] TIRES, BULK STORAGE OF.

[F] TROUBLE SIGNAL.

[F] VISIBLE ALARM NOTIFICATION APPLIANCE.

[F] WET-CHEMICAL EXTINGUISHING SYSTEM.

[F] WIRELESS PROTECTION SYSTEM.

[F] ZONE.

[F] ZONE, NOTIFICATION.

**SECTION 903**  
**AUTOMATIC SPRINKLER SYSTEMS**

[F] **903.1 General.** Automatic sprinkler systems shall comply with this section.

[F] **903.1.1 Alternative protection.** Alternative automatic fire-extinguishing systems complying with Section 904 shall be permitted in lieu of automatic sprinkler protection where recognized by the applicable standard and approved by the fire code official.

[F] **903.2 Where required.** Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in Sections 903.2.1 through 903.2.12.

[F] **903.2.1 Group A.** An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section. For Group A-1, A-2, A-3 and A-4 occupancies, the automatic sprinkler system shall be provided throughout the floor area where the Group A-1, A-2, A-3 or A-4 occupancy is located, and in all floors from the Group A occupancy to, and including, the nearest level of exit discharge serving the Group A occupancy. For Group A-5 occupancies, the automatic sprinkler system shall be provided in the spaces indicated in Section 903.2.1.5.

[F] **903.2.1.1 Group A-1.** An automatic sprinkler system shall be provided for Group A-1 occupancies where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m<sup>2</sup>);
2. The fire area has an occupant load of 300 or more;
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies; or
4. The fire area contains a multitheater complex.



**[F] 903.2.1.2 Group A-2.** An automatic sprinkler system shall be provided for Group A-2 occupancies where one of the following conditions exists:

1. The fire area exceeds 5,000 square feet (464.5 m<sup>2</sup>);
2. The fire area has an occupant load of 100 or more; or
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. *The structure exceeds 12,000 square feet (1115 m<sup>2</sup>), contains more than one fire area containing exhibition and display rooms, and is separated into two or more buildings by fire walls of less than four-hour fire resistance rating without openings.*

**[F] 903.2.1.3 Group A-3.** An automatic sprinkler system shall be provided for Group A-3 occupancies where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m<sup>2</sup>);
2. The fire area has an occupant load of 300 or more; or
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

**[F] 903.2.1.4 Group A-4.** An automatic sprinkler system shall be provided for Group A-4 occupancies where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m<sup>2</sup>);
2. The fire area has an occupant load of 300 or more; or
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

**[F] 903.2.1.5 Group A-5.** An automatic sprinkler system shall be provided for Group A-5 occupancies in the following areas: concession stands, retail areas, press boxes and other accessory use areas in excess of 1,000 square feet (93 m<sup>2</sup>).

**[F] 903.2.2 Ambulatory care facilities.** An automatic sprinkler system shall be installed throughout the entire floor containing an ambulatory care facility where either of the following conditions exist at any time:

1. Four or more care recipients are incapable of self-preservation, whether rendered incapable by staff or staff has accepted responsibility for care recipients already incapable.
2. One or more care recipients that are incapable of self-preservation are located at other than the level of exit discharge serving such a facility.

In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor where such care is provided as well as all floors below, and all floors between the level of ambulatory care

and the nearest level of exit discharge, including the level of exit discharge.

**[F] 903.2.3 Group E.** An automatic sprinkler system shall be provided for Group E occupancies as follows:

1. Throughout all Group E fire areas greater than 12,000 square feet (1115 m<sup>2</sup>) in area.
2. Throughout every portion of educational buildings below the lowest level of exit discharge serving that portion of the building.

**Exception:** An automatic sprinkler system is not required in any area below the lowest level of exit discharge serving that area where every classroom throughout the building has at least one exterior exit door at ground level.

3. *In rooms or areas with special hazards such as laboratories, vocational shops and other such areas where hazardous materials in quantities not exceeding the maximum allowable quantity are used or stored.*
4. *Throughout any Group E structure greater than 12,000 square feet (1115 m<sup>2</sup>) in area, which contains more than one fire area, and which is separated into two or more buildings by fire walls of less than four hour fire resistance rating without openings.*
5. *For public school state funded construction projects see Section 903.2.19.*

**[F] 903.2.4 Group F-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. A Group F-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m<sup>2</sup>).
4. A Group F-1 occupancy used for the manufacture of upholstered furniture or mattresses exceeds 2,500 square feet (232 m<sup>2</sup>).

**[F] 903.2.4.1 Woodworking operations.** An automatic sprinkler system shall be provided throughout all Group F-1 occupancy fire areas that contain woodworking operations in excess of 2,500 square feet (232 m<sup>2</sup>) in area which generate finely divided combustible waste or use finely divided combustible materials. *[SFM] A fire wall of less than four-hour fire-resistance rating, or any fire wall with openings, shall not be used to establish separate fire areas without openings.*

**[F] 903.2.5 Group H.** Automatic sprinkler systems shall be provided in high-hazard occupancies as required in Sections 903.2.5.1 through 903.2.5.3.

**[F] 903.2.5.1 General.** An automatic sprinkler system shall be installed in Group H occupancies.

**[F] 903.2.5.2 Group H-5.** An automatic sprinkler system shall be installed throughout buildings containing Group H-5 occupancies. The design of the sprinkler system shall not be less than that required by this code for the occupancy hazard classifications in accordance with Table 903.2.5.2. Where the design area of the sprinkler system consists of a corridor protected by one row of sprinklers, the maximum number of sprinklers required to be calculated is 13.

**[F] 903.2.5.3 Pyroxylin plastics.** An automatic sprinkler system shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg).

**[F] 903.2.5.4 Group H occupancies located above the 10th story.** The fire sprinkler system shall be designed and zoned to provide separate indication upon water-flow for each side of the 2-hour fire-smoke barrier above the 10th story.

**[F] TABLE 903.2.5.2  
GROUP H-5 SPRINKLER DESIGN CRITERIA**

LOCATION	OCCUPANCY HAZARD CLASSIFICATION
Fabrication areas	Ordinary Hazard Group 2
Service corridors	Ordinary Hazard Group 2
Storage rooms without dispensing	Ordinary Hazard Group 2
Storage rooms with dispensing	Extra Hazard Group 2
Corridors	Ordinary Hazard Group 2

**[F] 903.2.6 Group I.** An automatic sprinkler system shall be provided throughout buildings with a Group I fire area.

**Exceptions:**

1. Those areas exempted by Section 407.5 of the California Building Code.
2. Pursuant to health and Safety Code Section 13113(d), Group I-2 occupancies, or any alterations thereto, located in Type IA construction in existence on March 4, 1972.

**[F] 903.2.6.1 Group I-2.** In an existing, unsprinklered Group I-2, nurses' station open to fire-resistive exit access corridors shall be protected by an automatic sprinkler system located directly above the nurses' station. It shall be permitted to connect the automatic sprinkler system to the domestic water service.

**[F] 903.2.6.2 Group I-3.** Every building, or portion thereof, where inmates or persons are in custody or restrained shall be protected by an automatic sprinkler system conforming to NFPA 13. The main sprinkler control valve or valves and all other control valves in the system shall be locked in the open position and electrically supervised so that at least an audible and visual alarm will sound at a constantly attended location when valves are closed. The sprinkler branch piping serving cells may be embedded in the concrete construction.

**[F] 903.2.7 Group M.** An automatic sprinkler system shall be provided throughout buildings containing a Group

M occupancy where one of the following conditions exists:

1. A Group M fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. A Group M fire area is located more than three stories above grade plane.
3. The combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m<sup>2</sup>).
4. A Group M occupancy used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m<sup>2</sup>).
5. The structure exceeds 24,000 square feet (465 m<sup>2</sup>), contains more than one fire area containing a Group M occupancy, and is separated into two or more buildings by fire walls of less than 4-hour fire resistance rating without openings.

**[F] 903.2.7.1 High-piled storage.** An automatic sprinkler system shall be provided in accordance with the California Fire Code in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

**907.3.2.1** In other than Group I, R-2.1 and Group R-4, occupancies for single-story buildings smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces. For multiple-story buildings smoke detectors shall be installed throughout all occupied areas and mechanical/electrical spaces for the story where delayed egress devices are installed. Additional detectors are required on adjacent stories where occupants of those stories utilize the same means of egress.

**Exception:** Refer to 907.3.2.4 for Group A court-house occupancies.

**[F] 903.2.8 Group R.** An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.

**Exceptions:**

1. Existing Group R-3 occupancies converted to Group R-3.1 occupancies not housing bedridden clients, not housing nonambulatory clients above the first floor and not housing clients above the second floor.
2. Existing Group R-3 occupancies converted to Group R-3.1 occupancies housing only one bedridden client and complying with Section 425.8.3.3.
3. Pursuant to Health and Safety Code Section 13113 occupancies housing ambulatory children only, none of whom are mentally ill or mentally retarded, and the buildings or portions thereof in which such children are housed are not more than two stories in height, and buildings or portions thereof housing such children have an auto-

*matic fire alarm system activated by approved smoke detectors.*

4. Pursuant to Health and Safety Code Section 13143.6 occupancies licensed for protective social care which house ambulatory clients only, none of whom is a child (under the age of 18 years), or who is elderly (65 years of age or over).

*When not used in accordance with Section 504.2 or 506.3 an automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be allowed in Group R-2.1 occupancies.*

*An automatic sprinkler system designed in accordance with Section 903.3.1.3 shall not be utilized in Group R-2.1 or R-4 occupancies.*

**[F] 903.2.8.1 Group R-3 congregate residences.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3 or congregate residences with 16 or fewer residents.

**[F] 903.2.9 Group S-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. A Group S-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group S-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m<sup>2</sup>).
4. A Group S-1 fire area used for the storage of commercial trucks or buses where the fire area exceeds 5,000 square feet (464 m<sup>2</sup>).
5. A Group S-1 occupancy used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m<sup>2</sup>).

**[F] 903.2.9.1 Repair garages.** An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406, as shown:

1. Buildings having two or more stories above grade plane, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m<sup>2</sup>).
2. Buildings no more than one story above grade plane, with a fire area containing a repair garage exceeding 12,000 square feet (1115 m<sup>2</sup>).
3. Buildings with repair garages servicing vehicles parked in basements.
4. A Group S-1 fire area used for the repair of commercial trucks or buses where the fire area exceeds 5,000 square feet (464 m<sup>2</sup>).

**[F] 903.2.9.2 Bulk storage of tires.** Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m<sup>3</sup>) shall be equipped

throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**[F] 903.2.10 Group S-2 enclosed parking garages.** An automatic sprinkler system shall be provided throughout buildings classified as enclosed parking garages in accordance with Section 406.4 as follows:

1. Where the fire area of the enclosed parking garage exceeds 12,000 square feet (1115 m<sup>2</sup>); or
2. Where the enclosed parking garage is located beneath other groups.

**[F] 903.2.10.1 Commercial parking garages.** An automatic sprinkler system shall be provided throughout buildings used for storage of commercial trucks or buses where the fire area exceeds 5,000 square feet (464 m<sup>2</sup>).

**[F] 903.2.11 Specific building areas and hazards.** In all occupancies other than Group U, an automatic sprinkler system shall be installed for building design or hazards in the locations set forth in Sections 903.2.11.1 through 903.2.11.6.

**[F] 903.2.11.1 Stories without openings.** An automatic sprinkler system shall be installed throughout all stories, including basements, of all buildings where the floor area exceeds 1,500 square feet (139.4 m<sup>2</sup>) and where there is not provided at least one of the following types of exterior wall openings:

1. Openings below grade that lead directly to ground level by an exterior stairway complying with Section 1009 or an outside ramp complying with Section 1010. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm).
2. Openings entirely above the adjoining ground level totaling at least 20 square feet (1.86 m<sup>2</sup>) in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm). The height of the bottom of the clear opening shall not exceed 44 inches (1118 mm) measured from the floor.

**[F] 903.2.11.1.1 Opening dimensions and access.** Openings shall have a minimum dimension of not less than 30 inches (762 mm). Such openings shall be accessible to the fire department from the exterior and shall not be obstructed in a manner that fire fighting or rescue cannot be accomplished from the exterior.

**[F] 903.2.11.1.2 Openings on one side only.** Where openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22 860 mm) from such openings, the story shall

be equipped throughout with an approved automatic sprinkler system, or openings as specified above shall be provided on at least two sides of the story.

**[F] 903.2.11.1.3 Basements.** Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by Section 903.2.11.1, or where walls, partitions or other obstructions are installed that restrict the application of water from hose streams, the basement shall be equipped throughout with an approved automatic sprinkler system.

**[F] 903.2.11.2 Rubbish and linen chutes.** An automatic sprinkler system shall be installed at the top of rubbish and linen chutes and in their terminal rooms. Chutes shall have additional sprinkler heads installed at alternate floors and at the lowest intake. Where a rubbish chute extends through a building more than one floor below the lowest intake, the extension shall have sprinklers installed that are recessed from the drop area of the chute and protected from freezing in accordance with Section 903.3.1.1. Such sprinklers shall be installed at alternate floors, beginning with the second level below the last intake and ending with the floor above the discharge. Chute sprinklers shall be accessible for servicing.

**[F] 903.2.11.3 Buildings 55 feet or more in height.** An automatic sprinkler system shall be installed throughout buildings with a floor level having an occupant load of 30 or more that is located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access.

**Exceptions:**

1. Airport control towers.
2. Open parking structures.
3. Occupancies in Group F-2.

**[F] 903.2.11.4 Ducts conveying hazardous exhausts.** Where required by the *California Mechanical Code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust, or flammable or combustible materials.

**Exception:** Ducts in which the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

**[F] 903.2.11.5 Commercial cooking operations.** An automatic sprinkler system shall be installed in commercial kitchen exhaust hood and duct system where an automatic sprinkler system is used to comply with Section 904.

**[F] 903.2.11.6 Other required suppression systems.** In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.11.6 also require the installation of a fire suppression system for certain buildings and areas.

**[F] TABLE 903.2.11.6  
ADDITIONAL REQUIRED SUPPRESSION SYSTEMS**

SECTION	SUBJECT
914.2.1	Covered malls
914.3.1	High-rise buildings
402.10	Covered malls
403.3	High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access
404.3	Atriums
405.3	Underground structures
407.6	Group I-2
410.7	Stages
411.4	Special amusement buildings
412.4.6, 412.4.6.1, 412.6.5	Aircraft hangars
415.10.11	Group H-5 HPM exhaust ducts
416.5	Flammable finishes
417.4	Drying rooms
430	Horse racing stables
431	Pet kennels
439	Public libraries
507	Unlimited area buildings
509.4	Incidental uses
1028.6.2.3	Smoke-protected assembly seating
CFC	Sprinkler system requirements as set forth in Section 903.2.11.6 of the <i>California Fire Code</i>

For SI: 1 cubic foot = 0.23 m<sup>3</sup>.

**[F] 903.2.12 During construction.** Automatic sprinkler systems required during construction, alteration and demolition operations shall be provided in accordance with Chapter 33 of the *California Fire Code*.

**903.2.13 Reserved.**

**903.2.14 Motion picture and television production studio sound stages, approved production facilities and production locations.**

**903.2.14.1 Existing sound stages and approved production facilities.** All existing sound stages and approved production facilities equipped with an automatic fire sprinkler system shall be maintained in accordance with the provisions of *California Fire Code* Chapter 9.

**903.2.14.2 New sound stages.** All new sound stages shall be equipped with an approved automatic fire sprinkler system. The system shall be installed in accordance with the provisions of the *California Fire Code* Chapter 9 and shall meet the minimum design requirements of an Extra Hazard, Group 2 system.

**903.2.15 Automatic sprinkler system—existing highrise buildings.** See Section 3414.27.

**903.2.15.1 Existing Group R-1 and R-2 high-rise buildings fire-extinguishing systems.** See Section 3413.13.3.3.

**903.2.16 Group L occupancies.** An automatic sprinkler system shall be installed throughout buildings housing Group L occupancies. Sprinkler system design for research laboratories and similar areas of a Group L occupancy shall not be less than that required for Ordinary Hazard Group 2 with a design area of not less than 3,000 square feet (279 m<sup>2</sup>).

In mixed occupancies, portions of floors or buildings not classified as Group L occupancies shall be provided with sprinkler protection designed of not less than that required for Ordinary Hazard Group 1 with a design area of not less than 3,000 square feet (279 m<sup>2</sup>).

**903.2.16.1 Group L occupancies located above the 10th story.** The automatic sprinkler system shall be designed and zoned to provide separate indication upon water-flow for each side of the 2-hour fire-smoke barrier above the 10th story.

**903.2.17 Fixed guideway transit systems.**

**903.2.17.1 Automatic sprinkler system.** An automatic sprinkler system shall be installed in all stations of fixed guideway transit systems.

**Exceptions:**

1. Guideways when the closest sprinkler heads to the guideway are within 3 feet (914 mm) of the edge, over the platform, and spaced 6 feet (1829 mm) on center parallel to the guideway
2. Station agent booths not exceeding 150 square feet (13.9 m<sup>2</sup>) in area, when provided with an approved smoke detector connected to the building fire alarm system
3. Power substations
4. Machinery rooms, electrical rooms and train control rooms protected by an approved automatic fixed fire-extinguishing system
5. Open stations
6. Station platform areas open to three or more sides

**903.2.17.2 Station guideway deluge system.** Underground stations and stations in open cuts with walls 5 feet (1524 mm) above the top of the running rail and with a raised platform shall be provided with an under-vehicle guideway manually activated deluge sprinkler system. In open cut stations, such system shall be provided in guideways which are situated between a raised platform edge and a retaining wall.

**903.2.17.2.1** Systems shall be provided along the entire length of track at each station platform.

**903.2.17.2.2** Deluge nozzles with caps shall be located in the approximate center of track with spacing designed to completely wet the undersides of the vehicle at the applied density.

**903.2.17.2.3** System density shall be a minimum of 0.19 gallon per minute (gpm) per square foot (0.72 L/m per m<sup>2</sup>) for the design area. When more than one zone is provided, two adjacent zones are required to be considered operating for calculating purposes.

**903.2.17.2.4** Deluge systems shall be directly connected to a water supply capable of supplying the required flow rate for a minimum 30-minute duration.

**903.2.17.2.5** Controls or manually operable valves shall be in a location acceptable to the Fire Code Official. All deluge systems shall be monitored by the station fire alarm system.

**903.2.17.2.6** Each valve shall be monitored by a separate circuit. The alarm panel shall be located in an area normally occupied by station personnel or signals shall be transmitted to the operations control center (OCC).

**903.2.18 Group U private garages and carports accessory to Group R-3 occupancies.** Carports with habitable space above and attached garages, accessory to Group R-3 occupancies, shall be protected by residential fire sprinklers in accordance with this section. Residential fire sprinklers shall be connected to, and installed in accordance with, an automatic residential fire sprinkler system that complies with Section R313 of the California Residential Code or with NFPA 13D. Fire sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a minimum density of 0.05 gpm/ft<sup>2</sup> (2.04 mm/min) over the area of the garage and/or carport, but not to exceed two sprinklers for hydraulic calculation purposes. Garage doors shall not be considered obstructions with respect to sprinkler placement.

**Exception:** An automatic residential fire sprinkler system shall not be required when additions or alterations are made to existing carports and/or garages that do not have an automatic residential fire sprinkler system installed in accordance with this section.

**903.2.19 Public school state funded construction projects for kindergarten through 12th grade - automatic sprinkler system requirements.**

**903.2.19.1 New public school campus.** An automatic sprinkler system shall be provided in all occupancies. The provisions of this section shall apply to any public school project consisting of one or more buildings on a new school campus and receiving state funds pursuant to Leroy F. Greene School Facilities Act of 1998, California Education Code sections 17070.10 through 17079. For purposes of this section, new campus refers

to a school site, where an application for construction of original buildings was made to DSA on or after July 1, 2002.

**Exceptions:**

1. A relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. Also see CCR, Title 24, Part 1, California Administrative Code, Section 4-314 for definition of relocatable building.
2. Detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:
  - Concession Stand
  - Press Box
  - Restroom Facilities
  - Shade Structure
  - Snack Bar
  - Storage Building
  - Ticket Booth

**903.2.19.1.1** Sprinklers shall be installed in spaces where the ceiling creates a "ceiling-plenum" or space above the ceiling is utilized for environmental air.

**903.2.19.1.2 Fire-resistive substitution for new campus.** A new public school campus shall be entitled to include in the design and construction documents all of the applicable fire-resistive construction substitutions as permitted by this code.

**[F] 903.3 Installation requirements.** Automatic sprinkler systems shall be designed and installed in accordance with Sections 903.3.1 through 903.3.6.

**[F] 903.3.1 Standards.** Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1 unless otherwise permitted by Sections 903.3.1.2 and 903.3.1.3 and other chapters of this code, as applicable.

**[F] 903.3.1.1 NFPA 13 sprinkler systems.** Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Section 903.3.1.1.1.

**[F] 903.3.1.1.1 Exempt locations.** In other than Group I-2, I-2.1 and I-3 occupancies automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system in accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from any room merely because it is damp, of fire-resistance-rated construction or contains electrical equipment.

1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard.
2. Any room or space where sprinklers are considered undesirable because of the nature of the contents, when approved by the fire code official.
3. Fire service access elevator machine rooms and machinery spaces.
4. Machine rooms and machinery spaces associated with occupant evacuation elevators designed in accordance with Section 3008.
5. Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, and associated electrical power distribution equipment, provided those spaces or areas are equipped throughout with an automatic smoke detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or not less than 2-hour horizontal assemblies constructed in accordance with Section 712, or both.
6. Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
7. Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

**[F] 903.3.1.2 NFPA 13R sprinkler systems.** Automatic sprinkler systems in Group R occupancies up to and including four stories in height shall be permitted to be installed throughout in accordance with NFPA 13R as amended in Chapter 35.

**[F] 903.3.1.2.1 Balconies and decks.** Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of dwelling units where the building is of Type V construction, provided there is a roof or deck above. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

**[F] 903.3.1.3 NFPA 13D sprinkler systems.** Automatic sprinkler systems installed in one- and two-family dwellings, Group R-3 congregate residences and townhouses shall be permitted to be installed throughout in accordance with NFPA 13D.

**[F] 903.3.2 Quick-response and residential sprinklers.**

Where automatic sprinkler systems are required by this code, quick-response or residential automatic sprinklers shall be installed in the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing care recipient sleeping units in Group I-2 in accordance with this code.
2. Throughout all spaces within a smoke compartment containing treatment rooms in ambulatory care facilities.
3. Dwelling units and sleeping units in Group R occupancies.
4. Light-hazard occupancies as defined in NFPA 13.

**[F] 903.3.3 Obstructed locations.** Automatic sprinklers shall be installed with due regard to obstructions that will delay activation or obstruct the water distribution pattern. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds 4 feet (1219 mm) in width. Not less than a 3-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

**Exception:** Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.

**[F] 903.3.4 Actuation.** Automatic sprinkler systems shall be automatically actuated unless specifically provided for in this code.

**[F] 903.3.5 Water supplies.** Water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with *Health and Safety Code Section 13114.7*.

**[F] 903.3.5.1 Domestic services.** Where the domestic service provides the water supply for the automatic sprinkler system, the supply shall be in accordance with this section.

**[F] 903.3.5.1.1 Limited area sprinkler systems.**

Limited area sprinkler systems serving fewer than 20 sprinklers on any single connection are permitted to be connected to the domestic service where a wet automatic standpipe is not available. Limited area sprinkler systems connected to domestic water supplies shall comply with each of the following requirements:

1. Valves shall not be installed between the domestic water riser control valve and the sprinklers.

**Exception:** An approved indicating control valve supervised in the open position in accordance with Section 903.4.

2. The domestic service shall be capable of supplying the simultaneous domestic demand and the sprinkler demand required to be hydraulically

calculated by NFPA 13, NFPA 13D or NFPA 13R.

**[F] 903.3.5.1.2 Residential combination services.**

A single combination water supply shall be allowed provided that the domestic demand is added to the sprinkler demand as required by NFPA 13R.

**[F] 903.3.5.2 Secondary water supply.** An automatic secondary on-site water supply having a *usable* capacity of not less than the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 ft above the lowest level of fire department vehicle access assigned to Seismic Design Category C, D, E or F as determined by the *California Building Code*. An additional fire pump shall not be required for the secondary water supply unless needed to provide the minimum design intake pressure at the suction side of the fire pump supplying the automatic sprinkler system. The secondary water supply shall have a duration of not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13, *whichever is greater. The Class I standpipe system demand shall not be required to be included in the secondary on-site water supply calculations. In no case shall the secondary on-site water supply be less than 15,000 gallons.*

**Exception:** Existing buildings.

**[F] 903.3.6 Hose threads.** Fire hose threads and fittings used in connection with automatic sprinkler systems shall be as prescribed by the fire code official.

**[F] 903.3.7 Fire department connections.** *The location of fire department connections shall be approved by the fire code official.*

**[F] 903.3.8 Floor control valves.** *Floor control valves and waterflow detection assemblies shall be installed at each floor where any of the following occur:*

1. *Buildings where the floor level of the highest story is located more than 30 feet above the lowest level of fire department vehicle access*
2. *Buildings that are four or more stories in height*
3. *Buildings that are two or more stories below the highest level of fire department vehicle access*

**Exception:** *Group R-3 and R-3.1 occupancies floor control valves and waterflow detection assemblies shall not be required.*

**[F] 903.4 Sprinkler system supervision and alarms.** All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures and waterflow switches on all sprinkler systems shall be electrically supervised by a listed fire alarm control unit.

**Exceptions:**

1. Automatic sprinkler systems protecting one- and two-family dwellings.

2. Limited area systems serving fewer than 20 sprinklers.
3. Automatic sprinkler systems installed in accordance with NFPA 13R where a common supply main is used to supply both domestic water and the automatic sprinkler system, and a separate shutoff valve for the automatic sprinkler system is not provided.
4. Jockey pump control valves that are sealed or locked in the open position.
5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position.
6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position.
7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.

**[F] 903.4.1 Monitoring.** Alarm, supervisory and trouble signals shall be distinctly different and shall be automatically transmitted to an approved supervising station or, when approved by the fire code official, shall sound an audible signal at a constantly attended location.

**Exceptions:**

1. Underground key or hub valves in roadway boxes provided by the municipality or public utility are not required to be monitored.
2. Backflow prevention device test valves located in limited area sprinkler system supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.

**[F] 903.4.2 Alarms.** *One exterior approved* audible device, located on the exterior of the building in an approved location, shall be connected to each automatic sprinkler system. Such sprinkler water-flow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system. *Visible alarm notification appliances shall not be required except when required by Section 907.*

**[F] 903.4.3 Floor control valves.** Approved supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access.

**[F] 903.5 Testing and maintenance.** Sprinkler systems shall be tested and maintained in accordance with the *California Fire Code*.

## SECTION 904 ALTERNATIVE AUTOMATIC FIRE-EXTINGUISHING SYSTEMS

**[F] 904.1 General.** Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of this section and the applicable referenced standards.

**[F] 904.2 Where required.** Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the fire code official. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed by other requirements of this code.

**[F] 904.2.1 Commercial hood and duct systems.** Each required commercial kitchen exhaust hood and duct system required by Section 609 of the *California Fire Code* or Chapter 5 of the *California Mechanical Code* to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with this code.

**[F] 904.3 Installation.** Automatic fire-extinguishing systems shall be installed in accordance with this section.

**[F] 904.3.1 Electrical wiring.** Electrical wiring shall be in accordance with *California Electrical Code*.

**[F] 904.3.2 Actuation.** Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.11.1. Where more than one hazard could be simultaneously involved in fire due to their proximity, all hazards shall be protected by a single system designed to protect all hazards that could become involved.

**Exception:** Multiple systems shall be permitted to be installed if they are designed to operate simultaneously.

**[F] 904.3.3 System interlocking.** Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required by the design and installation standard utilized for the hazard.

**[F] 904.3.4 Alarms and warning signs.** Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with Section 907.5.2.

**[F] 904.3.5 Monitoring.** Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with NFPA 72.



**[F] 904.4 Inspection and testing.** Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of this section prior to acceptance.

**[F] 904.4.1 Inspection.** Prior to conducting final acceptance tests, the following items shall be inspected:

1. Hazard specification for consistency with design hazard.
2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

**[F] 904.4.2 Alarm testing.** Notification appliances, connections to fire alarm systems and connections to approved supervising stations shall be tested in accordance with this section and Section 907 to verify proper operation.

**[F] 904.4.2.1 Audible and visible signals.** The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

**[F] 904.4.3 Monitor testing.** Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

**[F] 904.5 Wet-chemical systems.** Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 17A and their listing.

**[F] 904.6 Dry-chemical systems.** Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 17 and their listing.

**[F] 904.7 Foam systems.** Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*, NFPA 11 and NFPA 16 and their listing.

**[F] 904.8 Carbon dioxide systems.** Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 12 and their listing.

**[F] 904.9 Halon systems.** Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 12A and their listing.

**[F] 904.10 Clean-agent systems.** Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 2001 and their listing.

**[F] 904.11 Commercial cooking systems.** *Commercial cooking equipment that produces grease laden vapors shall be provided with a Type I Hood, in accordance with the California Mechanical Code, and an automatic fire extinguishing system that is listed and labeled for its intended use as follows:*

1. *Wet chemical extinguishing system, complying with UL 300.*
2. *Carbon dioxide extinguishing systems.*
3. *Automatic fire sprinkler systems All existing dry chemical and wet chemical extinguishing systems shall comply with UL 300.*

**Exceptions:**

1. *Public schools kitchens, without deep-fat fryers, shall be upgraded to a UL 300 compliant system during state funded modernization projects that are under the jurisdiction of the Division of the State Architect.*
2. *All systems shall be installed in accordance with the California Mechanical Code, appropriate adopted standards, their listing and the manufacturer's installation instructions.*

**Exception:** Factory-built commercial cooking recirculating systems that are tested, listed, labeled and installed in accordance with UL 710B and the *California Mechanical Code*.

**[F] 904.11.1 Manual system operation.** A manual actuation device shall be located at or near a means of egress from the cooking area a minimum of 10 feet (3048 mm) and a maximum of 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be installed not more than 48 inches (1200 mm) or less than 42 inches (1067 mm) above the floor and shall clearly identify the hazard protected. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

**Exception:** Automatic sprinkler systems shall not be required to be equipped with manual actuation means.

**[F] 904.11.2 System interconnection.** The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

**[F] 904.11.3 Carbon dioxide systems.** When carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom

of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

**[F] 904.11.3.1 Ventilation system.** Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation.

**[F] 904.11.4 Special provisions for automatic sprinkler systems.** Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, readily accessible, indicating-type control valve that is identified.

**[F] 904.11.4.1 Listed sprinklers.** Sprinklers used for the protection of fryers shall be tested in accordance with UL 199E, listed for that application and installed in accordance with their listing.

## SECTION 905 STANDPIPE SYSTEMS

**[F] 905.1 General.** Standpipe systems shall be provided in new buildings and structures in accordance with this section. Fire hose threads used in connection with standpipe systems shall be approved and shall be compatible with fire department hose threads. The location of fire department hose connections shall be approved. In buildings used for high-piled combustible storage, fire protection shall be in accordance with the *California Fire Code*.

**[F] 905.2 Installation standard.** Standpipe systems shall be installed in accordance with this section and NFPA 14.

**[F] 905.3 Required installations.** Standpipe systems shall be installed where required by Sections 905.3.1 through 905.3.11.1. Standpipe systems are allowed to be combined with automatic sprinkler systems.

**Exception:** Standpipe systems are not required in Group R-3 occupancies.

**[F] 905.3.1 Height.** *In other than Group R-3 and R-3.1 occupancies, Class III standpipe systems shall be installed throughout at each floor where any of the following occur:*

1. *Buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access.*
2. *Buildings that are four or more stories in height.*
3. *Buildings where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.*
4. *Buildings that are two or more stories below the highest level of fire department vehicle access.*

### Exceptions:

1. Class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler

**[F] TABLE 906.1  
ADDITIONAL REQUIRED PORTABLE FIRE EXTINGUISHERS IN  
THE CALIFORNIA FIRE CODE**

IFC SECTION	SUBJECT
303.5	Asphalt kettles
307.5	Open burning
308.1.3	Open flames—torches
309.4	Powered industrial trucks
2005.2	Aircraft towing vehicles
2005.3	Aircraft welding apparatus
2005.4	Aircraft fuel-servicing tank vehicles
2005.5	Aircraft hydrant fuel-servicing vehicles
2005.6	Aircraft fuel-dispensing stations
2007.7	Heliports and helistops
2108.4	Dry cleaning plants
2305.5	Motor fuel-dispensing facilities
2310.6.4	Marine motor fuel-dispensing facilities
2311.6	Repair garages
2404.4.1	Spray-finishing operations
2405.4.2	Dip-tank operations
2406.4.2	Powder-coating areas
2804.2	Lumberyards/woodworking facilities
2808.8	Recycling facilities
2809.5	Exterior lumber storage
2903.5	Organic-coating areas
3006.3	Industrial ovens
3104.12	Tents and membrane structures
3206.1	Rack storage
3315.1	Buildings under construction or demolition
3317.3	Roofing operations
3408.2	Tire rebuilding/storage
3504.2.6	Welding and other hot work
3604.4	Marinas
5203.6	Combustible fibers
5703.2.1	Flammable and combustible liquids, general
5704.3.3.1	Indoor storage of flammable and combustible liquids
5704.3.7.5.2	Liquid storage rooms for flammable and combustible liquids
5705.4.9	Solvent distillation units
5706.2.7	Farms and construction sites—flammable and combustible liquids storage
5706.4.10.1	Bulk plants and terminals for flammable and combustible liquids
5706.5.4.5	Commercial, industrial, governmental or manufacturing establishments—fuel dispensing
5706.6.4	Tank vehicles for flammable and combustible liquids
5906.5.7	Flammable solids
6108.2	LP-gas

system in accordance with Section 903.3.1.1 or 903.3.1.2.

2. Class I manual standpipes are allowed in open parking garages where the highest floor is located not more than 150 feet (45 720 mm) above the lowest level of fire department vehicle access.
3. Class I manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class II standpipes in accordance with Section 905.5.
4. Class I standpipes are allowed in basements equipped throughout with an automatic sprinkler system.
5. In determining the lowest level of fire department vehicle access, it shall not be required to consider:
  - 5.1. Recessed loading docks for four vehicles or less; and
  - 5.2. Conditions where topography makes access from the fire department vehicle to the building impractical or impossible.

**[F] 905.3.2 Group A.** Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.

**Exceptions:**

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings that are not high-rise buildings.

**[F] 905.3.3 Covered and open mall buildings.** Covered mall and open mall buildings shall be equipped throughout with a standpipe system where required by Section 905.3.1. Mall buildings not required to be equipped with a standpipe system by Section 905.3.1 shall be equipped with Class I hose connections connected to the automatic sprinkler system sized to deliver water at 250 gallons per minute (946.4 L/min) at the most hydraulically remote hose connection while concurrently supplying the automatic sprinkler system demand. The standpipe system shall be designed to not exceed a 50 pounds per square inch (psi) (345 kPa) residual pressure loss with a flow of 250 gallons per minute (946.4 L/min) from the fire department connection to the hydraulically most remote hose connection. Hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passage-way or corridor.
2. At each floor-level landing within enclosed stairways opening directly on the mall.
3. At exterior public entrances to the mall of a covered mall building.
4. At public entrances at the perimeter line of an open mall building.

5. At other locations as necessary so that the distance to reach all portions of a tenant space does not exceed 200 feet (60 960 mm) from a hose connection.

**[F] 905.3.4 Stages.** Stages greater than 1,000 square feet in area (93 m<sup>2</sup>) shall be equipped with a Class III wet standpipe system with 1½-inch and 2½-inch (38 mm and 64 mm) hose connections on each side of the stage.

**Exception:** Where the building or area is equipped throughout with an automatic sprinkler system, a 1½-inch (38 mm) hose connection shall be installed in accordance with NFPA 13 or in accordance with NFPA 14 for Class II or III standpipes.

**[F] 905.3.4.1 Hose and cabinet.** The 1½-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1½-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

**[F] 905.3.5 Underground buildings.** Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

**[F] 905.3.6 Helistops and heliports.** Buildings with a rooftop helistop or heliport shall be equipped with a Class I or III standpipe system extended to the roof level on which the helistop or heliport is located in accordance with Section 2007.5 of the *California Fire Code*.

**[F] 905.3.7 Marinas and boatyards.** Standpipes in marinas and boatyards shall comply with Chapter 36 of the *California Fire Code*.

**[F] 905.3.8 Rooftop gardens and landscaped roofs.** Buildings or structures that have rooftop gardens or landscaped roofs and that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the rooftop garden or landscaped roof is located.

**[F] 905.3.9 Smokeproof enclosures.** For smokeproof enclosures see Section 909.20.

**[F] 905.3.10 Group I-3.** Housing units within cell complexes where 50 or more inmates are restrained, shall be provided with Class I wet standpipes. In addition, Class I wet standpipes shall be located so that it will not be necessary to extend hose lines through interlocking security doors and any doors in smoke-barrier walls, horizontal fire walls or fire barrier walls. Standpipes located in cell complexes may be placed in secured pipe chases.

**[F] 905.3.11 Fixed guideway transit systems.** Underground stations shall be provided with a class III standpipe system designed to comply with the following:

1. Automatically supply 65 pounds per square inch (psi) for each outlet.
2. Supply a 250 gpm (946 L/m) flow to each of the two most remote 2½ inch (64 mm) outlets when pressurized through the fire department connection(s).

**[F] 905.3.11.1** All other stations shall be provided with a class I manual wet standpipe system; a manual dry class I

*standpipe system may be allowed in areas subject to freezing.*

**Exception:** *Open at-grade stations with unrestricted fire department access need not be provided with a standpipe system.*

**[F] 905.4 Location of Class I standpipe hose connections.** Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required stairway, a hose connection shall be provided for each floor level above or below grade. Hose connections shall be located at an intermediate floor level landing between floors, unless otherwise approved by the fire code official. *See Section 909.20.2.3 for additional provisions in smokeproof enclosures.*

2. On each side of the wall adjacent to the exit opening of a horizontal exit.

**Exception:** Where floor areas adjacent to a horizontal exit are reachable from exit stairway hose connections by a nozzle attached to 100 feet (30 480 mm) of hose *as measured along the path of travel*, a hose connection shall not be required at the horizontal exit.

3. In every exit passageway, at the entrance from the exit passageway to other areas of a building.

**Exception:** Where floor areas adjacent to an exit passageway are reachable from exit stairway hose connections by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the entrance from the exit passageway to other areas of the building.

4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall. In open mall buildings, adjacent to each public entrance to the mall at the perimeter line and adjacent to each entrance from an exit passageway or exit corridor to the mall.

5. Where the roof has a slope less than four units vertical in 12 units horizontal (33.3-percent slope), a hose connection shall be located to serve the roof or at the highest landing of a stairway with stair access to the roof provided in accordance with Section 1009.16.

6. Where the most remote portion of a nonsprinklered floor or story is more than 150 feet (45 720 mm) from a hose connection or the most remote portion of a sprinklered floor or story is more than 150 feet (45 720 mm) from a hose connection, the fire code official is authorized to require that additional hose connections be provided in approved locations. *The distances from a hose connection shall be measured along the path of travel.*

**[F] 905.4.1 Protection.** Risers and laterals of Class I standpipe systems not located within an enclosed stairway or pressurized enclosure shall be protected by a degree of

fire resistance equal to that required for vertical enclosures in the building in which they are located.

**Exception:** In buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an enclosed stairway or pressurized enclosure are not required to be enclosed within fire-resistance-rated construction.

**[F] 905.4.2 Interconnection.** In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

**[F] 905.5 Location of Class II standpipe hose connections.** Class II standpipe hose connections shall be accessible and located so that all portions of the building are within 30 feet (9144 mm) of a listed variable stream fog nozzle attached to 100 feet (30 480 mm) of hose.

**[F] 905.5.1 Groups A-1 and A-2.** In Group A-1 and A-2 occupancies having occupant loads exceeding 1,000 persons, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.

**[F] 905.5.2 Protection.** Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

**[F] 905.5.3 Class II system 1-inch hose.** A minimum 1-inch (25 mm) hose shall be permitted to be used for hose stations in light-hazard occupancies where investigated and listed for this service and where approved by the fire code official.

**[F] 905.6 Location of Class III standpipe hose connections.** Class III standpipe systems shall have hose connections located as required for Class I standpipes in Section 905.4 and shall have Class II hose connections as required in Section 905.5.

**[F] 905.6.1 Protection.** Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with Section 905.4.1.

**[F] 905.6.2 Interconnection.** In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

**[F] 905.7 Cabinets.** Cabinets containing fire-fighting equipment such as standpipes, fire hoses, fire extinguishers or fire department valves shall not be blocked from use or obscured from view.

**[F] 905.7.1 Cabinet equipment identification.** Cabinets shall be identified in an approved manner by a permanently attached sign with letters not less than 2 inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

**Exceptions:**

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.

- Doors that have either an approved visual identification clear glass panel or a complete glass door panel are not required to be marked.

**[F] 905.7.2 Locking cabinet doors.** Cabinets shall be unlocked.

**Exceptions:**

- Visual identification panels of glass or other approved transparent frangible material that is easily broken and allows access.
- Approved locking arrangements.
- Group I-3.

**[F] 905.8 Dry standpipes.** Dry standpipes shall not be installed.

**Exception:** Where subject to freezing and in accordance with NFPA 14.

**[F] 905.9 Valve supervision.** Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by Section 903.4. Where a fire alarm system is provided, a signal shall also be transmitted to the control unit.

**Exceptions:**

- Valves to underground key or hub valves in roadway boxes provided by the municipality or public utility do not require supervision.
- Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system.

**[F] 905.10 During construction.** Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 3311.

## SECTION 906 PORTABLE FIRE EXTINGUISHERS

**[F] 906.1 Where required.** Portable fire extinguishers shall be installed in the following locations.

- In Group A, B, E, F, H, I, L, M, R-1, R-2, R-2.1, R.3.1, R-4 and S occupancies.

**Exception:** In Group R-2 occupancies, portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each dwelling unit is provided with a portable fire extinguisher having a minimum rating of 1-A:10-B:C.

- Within 30 feet (9144 mm) of commercial cooking equipment.
- In areas where flammable or combustible liquids are stored, used or dispensed.
- On each floor of structures under construction, except Group R-3 occupancies, in accordance with Section 3315.1 of the *California Fire Code*.
- Where required by the *California Fire Code* sections indicated in Table 906.1.

- Special-hazard areas, including but not limited to laboratories, computer rooms and generator rooms, where required by the fire code official.

7. *Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2A10BC rating.*

8. *Where required by California Code of Regulations, Title 19, Division 1, Chapter 3.*

**[F] 906.2 General requirements.** Portable fire extinguishers shall be selected and installed in accordance with this section and *California Code of Regulations, Title 19, Division 1, Chapter 3*.

**Exceptions:**

- The travel distance to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.
- In Group I-3, portable fire extinguishers shall be permitted to be located at staff locations.

**[F] 906.3 Size and distribution.** The size and distribution of portable fire extinguishers shall be in accordance with Sections 906.3.1 through 906.3.4.

**[F] 906.3.1 Class A fire hazards.** The minimum sizes and distribution of portable fire extinguishers for occupancies that involve primarily Class A fire hazards shall comply with Table 906.3(1).

**[F] TABLE 906.3(1)  
FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS**

	LIGHT (Low) HAZARD OCCUPANCY	ORDINARY (Moderate) HAZARD OCCUPANCY	EXTRA (High) HAZARD OCCUPANCY
Minimum Rated Single Extinguisher	2-A <sup>c</sup>	2-A	4-A <sup>a</sup>
Maximum Floor Area Per Unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum Floor Area for Extinguisher <sup>b</sup>	11,250 square feet	11,250 square feet	11,250 square feet
Maximum Travel Distance to Extinguisher	75 feet	75 feet	75 feet

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929m<sup>2</sup>, 1 gallon = 3.785 L.

- Two 2½-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.
- California Code of Regulations, Title 19, Division 1, Chapter 3* concerning application of the maximum floor area criteria.
- Two water-type extinguishers each with a 1-A rating shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

**[F] 906.3.2 Class B fire hazards.** Portable fire extinguishers for occupancies involving flammable or combustible liquids with depths less than or equal to 0.25-inch (6.35 mm) shall be selected and placed in accordance with Table 906.3(2).

Portable fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25-inch (6.35 mm) shall be selected and placed in

> accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3*.

**[F] TABLE 906.3(2)**  
**FIRE EXTINGUISHERS FOR FLAMMABLE OR COMBUSTIBLE LIQUIDS WITH DEPTHS LESS THAN OR EQUAL TO 0.25 INCH**

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS (feet)
Light (Low)	5-B	30
	10-B	50
Ordinary (Moderate)	10-B	30
	20-B	50
Extra (High)	40-B	30
	80-B	50

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**Note:** For requirements on water-soluble flammable liquids and alternative sizing criteria, see *California Code of Regulations, Title 19, Division 1, Chapter 3*.

**[F] 906.3.3 Class C fire hazards.** Portable fire extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or B hazard.

**[F] 906.3.4 Class D fire hazards.** Portable fire extinguishers for occupancies involving combustible metals shall be selected and placed in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3*.

**[F] 906.4 Cooking grease fires.** Fire extinguishers provided for the protection of cooking grease fires shall be of an *approved* type compatible with the automatic fire-extinguishing system agent and in accordance with Section 904.11.5 of the *California Fire Code*.

**[F] 906.5 Conspicuous location.** Portable fire extinguishers shall be located in conspicuous locations where they will be readily accessible and immediately available for use. These locations shall be along normal paths of travel, unless the fire code official determines that the hazard posed indicates the need for placement away from normal paths of travel.

**[F] 906.6 Unobstructed and unobscured.** Portable fire extinguishers shall not be obstructed or obscured from view. In rooms or areas in which visual obstruction cannot be completely avoided, means shall be provided to indicate the locations of extinguishers.

**[F] 906.7 Hangers and brackets.** Hand-held portable fire extinguishers, not housed in cabinets, shall be installed on the hangers or brackets supplied. Hangers or brackets shall be securely anchored to the mounting surface in accordance with the manufacturer's installation instructions.

**[F] 906.8 Cabinets.** Cabinets used to house portable fire extinguishers shall not be locked.

**Exceptions:**

1. Where portable fire extinguishers subject to malicious use or damage are provided with a means of ready access.
2. In Group I-3 occupancies and in mental health areas in Group I-2 occupancies, access to portable fire extinguishers shall be permitted to be locked or to be located in staff locations provided the staff has keys.

**[F] 906.9 Extinguisher installation.** The installation of portable fire extinguishers shall be in accordance with Sections 906.9.1 through 906.9.3.

**[F] 906.9.1 Extinguishers weighing 40 pounds or less.** Portable fire extinguishers having a gross weight not exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 5 feet (1524 mm) above the floor.

**[F] 906.9.2 Extinguishers weighing more than 40 pounds.** Hand-held portable fire extinguishers having a gross weight exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 3.5 feet (1067 mm) above the floor.

**[F] 906.9.3 Floor clearance.** The clearance between the floor and the bottom of installed hand-held portable fire extinguishers shall not be less than 4 inches (102 mm).

**[F] 906.10 Wheeled units.** Wheeled fire extinguishers shall be conspicuously located in a designated location.

## SECTION 907

### FIRE ALARM AND DETECTION SYSTEMS

**[F] 907.1 General.** This section covers the application, installation, performance and maintenance of fire alarm systems and their components.

**[F] 907.1.1 Construction documents.** Construction documents for fire alarm systems shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code, the *California Fire Code*, and relevant laws, ordinances, rules and regulations, as determined by the fire code official.

**[F] 907.1.2 Fire alarm shop drawings.** Shop drawings for fire alarm systems shall be submitted for review and approval prior to system installation, and shall include, but not be limited to, all of the following:

1. A floor plan that indicates the use of all rooms.
2. Locations of alarm-initiating devices.
3. Locations of alarm notification appliances, including candela ratings for visible alarm notification appliances.
4. Location of fire alarm control unit, transponders and notification power supplies.
5. Annunciators.
6. Power connection.
7. Battery calculations.
8. Conductor type and sizes.
9. Voltage drop calculations.
10. Manufacturers' data sheets indicating model numbers and listing information for equipment, devices and materials.
11. Details of ceiling height and construction.
12. The interface of fire safety control functions.

13. Classification of the supervising station.

14. *All plans and shop drawings shall use the symbols identified in NFPA 170, Standard for Fire Safety and Emergency Symbols.*

**Exception:** *Other symbols are allowed where approved by the enforcing agency.*

**[F] 907.1.3 Equipment.** Systems and components shall be California State Fire Marshal listed and approved in accordance with California Code of Regulations, Title 19, Division 1 for the purpose for which they are installed.

**[F] 907.1.4 Fire-walls and fire barrier walls.** *For the purpose of Section 907 fire walls and fire barrier walls shall not define separate buildings.*

**[F] 907.1.5 Fire alarm use.** *A fire alarm system shall not be used for any purpose other than fire warning or mass notification and where permitted by NFPA 72.*

**[F] 907.2 Where required—new buildings and structures.** An approved fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23 and provide occupant notification in accordance with Section 907.5, unless other requirements are provided by another section of this code.

A minimum of one manual fire alarm box shall be provided in an approved location to initiate a fire alarm signal for fire alarm systems employing automatic fire detectors or waterflow detection devices. Where other sections of this code allow elimination of fire alarm boxes due to sprinklers, or automatic fire alarm systems, a single fire alarm box shall be installed at a location approved by the enforcing agency.

#### Exceptions:

1. The manual fire alarm box is not required for fire alarm control units dedicated to elevator recall control supervisory service and fire sprinkler monitoring.
2. The manual fire alarm box is not required for Group R-2 occupancies unless required by the fire code official to provide a means for fire watch personnel to initiate an alarm during a sprinkler system impairment event. Where provided, the manual fire alarm box shall not be located in an area that is accessible to the public.
3. *The manual fire alarm box is not required to be installed when approved by the fire code official.*

**[F] 907.2.1 Group A.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more. Group A occupancies not separated from one another in accordance with Section 707.3.9 shall be considered as a single occupancy for the purposes of applying this section. Portions of Group E occupancies occupied for assembly purposes with an occupant load of less than 1,000, shall be provided with a fire alarm system as required for the Group E occupancy.

**Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

*Every Group A building used for educational purposes shall be provided with a manual or automatic fire alarm system. This provision shall apply to, but shall not necessarily be limited to, every community college and university.*

**Exception:** *Privately owned trade or vocational schools or any firm or company which provides educational facilities and instructions for its employees.*

**[F] 907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more.** Activation of the fire alarm in Group A occupancies with an occupant load of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with Section 907.5.2.2. Group A occupancies with an occupant load of 10,000 or more, see Section 907.2.1.3.

**Exception:** Where approved, the prerecorded announcement is allowed to be manually deactivated for a period of time, not to exceed 3 minutes, for the sole purpose of allowing a live voice announcement from an approved, constantly attended location.

**[F] 907.2.1.2 Emergency voice/alarm communication captions.** Stadiums, arenas and grandstands required to caption audible public announcements shall be in accordance with Section 907.5.2.2.4.

**907.2.1.3 Public address system.** Pursuant to Health and Safety Code Section 13108.9, for all buildings or structures constructed on or after July 1, 1991, which are intended for public assemblies of 10,000 or more persons a public address system with an emergency backup power system shall be required.

**[F] 907.2.2 Group B.** A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B occupant load of all floors is 500 or more.
2. The Group B occupant load is more than 100 persons above or below the lowest level of exit discharge.
3. The fire area contains an ambulatory care facility.
4. *Group B occupancies containing educational facilities, see Section 907.2.2.2.*

**Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

**[F] 907.2.2.1 Ambulatory care facilities.** Fire areas containing ambulatory care facilities shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in public use areas outside of tenant spaces, including public corridors and elevator lobbies.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, provided the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

**907.2.2.2 Group B Educational facilities.** Every Group B building used for educational purposes shall be provided with a manual or automatic fire alarm system. This provision shall apply to, but shall not necessarily be limited to, every community college and university.

**Exception:** Privately owned trade or vocational schools or any firm or company which provides educational facilities and instructions for its employees.

**[F] 907.2.3 Group E.** A manual and automatic fire alarm system that initiates the occupant notification signal utilizing an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group E occupancies with an occupant load of 50 or more persons or containing more than one classroom or one or more rooms used for Group E or I-4 day care purposes in accordance with this section. When automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

**Exceptions:**

1. Manual fire alarm boxes are not required in Group E occupancies where all of the following apply:
  - 1.1. Interior corridors are protected by smoke detectors.
  - 1.2. Auditoriums, cafeterias, gymnasiums and similar areas are protected by heat detectors or other approved detection devices.
  - 1.3. Shops and laboratories involving dusts or vapors are protected by heat detectors or other approved detection devices.
  - 1.4. The capability to activate the evacuation signal from a central point is provided.
2. Manual fire alarm boxes shall not be required in Group E occupancies where the building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, the emergency voice/alarm communication system will activate on sprinkler water flow and manual activation is provided from a normally occupied location.

3. For public school state funded construction projects see Section 907.2.29.

**907.2.3.1 System connection.** Where more than one fire alarm control unit is used at the school campus, they shall be interconnected and shall operate all notification appliances.

**Exception:** Interconnection of fire alarm control units is not required when all the following are provided:

1. Buildings that are separated a minimum of 20 feet (6096 mm) and in accordance with the California Building Code; and
2. There is a method of two way communication between each classroom and the school administrative office approved by the fire enforcing agency; and
3. A method of manual activation of each fire alarm system is provided.

**907.2.3.2 Assemblies located within a Group E occupancy.** Assembly occupancies with an occupant load of less than 1,000 and located within a Group E occupancy campus or building shall be provided with a fire alarm system as required for the Group E occupancy.

**907.2.3.3 Notification.** The fire alarm system notification shall comply with the requirements of Section 907.5.

**Exception:** Emergency voice/alarm communication system is not required when existing facilities have other two-way communication, such as between classroom and administration office, when the communication system is approved by the authority having jurisdiction.

**907.2.3.4 Annunciation.** Annunciation of the fire alarm system shall comply with the requirements of Section 907.6.3.1.

**907.2.3.5 Monitoring.** School fire alarm systems shall be monitored in accordance with Section 907.6.5.2.

**907.2.3.6 Automatic fire alarm system.** Automatic detection shall be provided in accordance with this section.

**907.2.3.6.1 Smoke detectors.** Smoke detectors shall be installed at the ceiling of every room and in "ceiling-plenums" utilized for environmental air. Where the ceiling is attached directly to the underside of the roof structure, smoke detectors shall be installed on the ceiling only.

**Exception:** Where the environment or ambient conditions exceed smoke detector installation guidelines; heat detectors or fire sprinklers shall be used.

**907.2.3.6.2 Heat detectors.** Heat detectors shall be installed in combustible spaces where sprinklers or smoke detectors are not installed.



**907.2.3.7 Private schools.** *An automatic fire alarm system shall be provided in new buildings of private schools.*

**Exception:** *Automatic detection devices are not required where an approved automatic sprinkler system is installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.*

**907.2.3.8 Day-care, Group E.**

**907.2.3.8.1** *An automatic fire alarm system shall be provided in all buildings used as or containing a Group E day-care.*

**Exception:** *Automatic detection devices are not required where an approved automatic sprinkler system is installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.*

**907.2.3.8.2** *Smoke detectors shall be installed in every room used for sleeping or napping.*

**[F] 907.2.4 Group F.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:

1. The Group F occupancy is two or more stories in height; and
2. The Group F occupancy has a combined occupant load of 500 or more above or below the lowest level of exit discharge.

**Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

**[F] 907.2.5 Group H.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively, of the *California Fire Code*.

**907.2.5.1** *Group H occupancies located above the 10th story. Manual fire alarm boxes shall be required on each side of the 2-hour fire-smoke barrier and at each exit above the 10th story.*

**[F] 907.2.6 Group I.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group I occupancies. An automatic smoke detection system that activates the occupant notification system in accordance with Section

907.5 shall be provided in accordance with Sections 907.2.6.1, 907.2.6.2 and 907.2.6.3.3.

**Exceptions:**

1. Large family day-care.
2. Occupant notification systems are not required to be activated where private mode signaling installed in accordance with NFPA 72 is approved by the fire code official.

**[F] 907.2.6.1 Group I-1.** *Reserved.*

**[F] 907.2.6.2 Group I-2 and Group I-2.1.** A manual and automatic fire alarm system shall be installed in Group I-2 and I-2.1 occupancies. Where automatic fire suppression systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

**Exception:** *Where an entire facility is used for the housing of persons, none of whom are physically or mentally handicapped or nonambulatory, and are between the ages of 18 and 64, the buildings or structures comprising such facility shall be exempt from the provisions of this subsection relating to the installation of an automatic fire alarm system.*

**907.2.6.2.1 Notification.** *The fire alarm notification system shall be in accordance with Section 907.5.2.5.*

**907.2.6.2.2 Automatic fire detection.** *Smoke detectors shall be provided in accordance with this section.*

1. *In patient and client sleeping rooms. Actuation of such detectors shall cause a visual display on the corridor side of the room in which the detector is located and shall cause an audible and visual alarm at the respective nurses' station. A nurse call system listed for this function is an acceptable means of providing the audible and visual alarm at the respective nurses' station and corridor room display. Operation of the smoke detector shall not include any alarm verification feature.*

**Exception:** *In patient and client rooms equipped with existing automatic door closers having integral smoke detector, the integral detector is allowed to substitute for the room smoke detector, provided it meets all the required alerting functions.*

2. *Group I-2 nurses' stations. A minimum of one (1) smoke detector shall be installed at the nurses' station and centrally located.*
3. *In waiting areas and corridors onto which they open, in the same smoke compartment, in accordance with Section 407.2.1.*

**[F] 907.2.6.3 Group I-3 occupancies.** Group I-3 occupancies shall be equipped with a manual fire alarm sys-

tem and automatic smoke detection system installed for alerting staff.

**Exception:** *An automatic smoke detection system is not required within temporary holding cells.*

**[F] 907.2.6.3.1 System initiation.** Actuation of an automatic fire-extinguishing system, automatic sprinkler system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal which automatically notifies staff.

**[F] 907.2.6.3.2 Manual fire alarm boxes.** Manual fire alarm boxes are not required to be located in accordance with Section 907.4.2 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.

**[F] 907.2.6.3.2.1 Manual fire alarm boxes in detainee areas.** Manual fire alarm boxes are allowed to be locked in areas occupied by detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.

**[F] 907.2.6.3.3 Automatic smoke detection system.** An automatic smoke detection system shall be installed throughout resident housing areas, including sleeping units and contiguous day rooms, group activity spaces and other common spaces normally accessible to inmates.

**Exceptions:**

1. Other approved smoke detection arrangements may be used to prevent damage or tampering or for other purposes provided the function of detecting any fire is fulfilled and the location of the detectors is such that the speed of detection will be equivalent to that provided by the spacing and location required in accordance with NFPA 72 as referenced in Chapter 35. This may include the location of detectors in return air ducts from cells, behind grilles or in other locations. Spot type, combination duct and open area smoke detectors may be used when located not more than 14 inches (356mm) from the return air grill. For initiation and annunciation purposes, these detectors may be combined in groups of four. The fire code official having jurisdiction, however, must approve the proposed equivalent performance of the design.
2. For detention housing and/or mental health housing area(s), including correctional medical and mental health uses, automatic smoke detection system in sleeping units shall not be required when all of the following conditions are met:

2.1. All rooms, including the inmate cells are provided with an automatic sprinkler system in accordance with Section 903.3.1.1.

2.2. Building is continuously staffed by a correctional officer at all times.

2.3. The exception to Section 903.2.6.2 shall not apply.

3. Smoke detectors are not required to be installed in inmate cells with two or fewer occupants in detention facilities which do not have a correctional medical and mental health use.

4. Smoke detectors are not required to be installed in inmate day rooms of detention facilities where 24-hour direct visual supervision is provided by a correctional officer(s) and a manual fire alarm box is located in the control room.

**907.2.6.3.4 System annunciation.** A staff alerting fire alarm shall sound at all staff control stations on the floor of activation and an audible and visual signal shall be indicated on an annunciator at the facility control center upon activation of any automatic extinguishing system, automatic detection system, or any smoke detector or manual actuating or initiating device. In addition, where there are staff-control stations on the floor, an audible, visual and manual alarm shall be located in each staff control station.

Fire and trouble signals of fire alarm systems and sprinkler water-flow and supervisory signals of extinguishing systems shall be annunciated in an area designated as the facility control center which shall be constantly attended by staff personnel. All such signals shall produce both an audible signal and visual display at the facility control center indicating the building, floor zone or other designated area from which the signal originated in accordance with Section 907.6.3.

All local detention facilities within the scope of Section 6031.4 of the Penal Code shall have a automatic smoke detection system. A manual fire alarm-initiating device shall be installed in all guard control stations and shall be capable of alerting personnel in a central control point to the presence of fire or smoke within the facility.

**907.2.6.4. Large family day-care.** Every large family day-care home shall be provided with at least one manual device at a location approved by the authority having jurisdiction. Such device shall actuate a fire alarm signal, which shall be audible throughout the facility at a minimum level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel or be electrically supervised or provided with emergency power. Such device or devices shall be attached to the struc-

*ture and may be of any type acceptable to the enforcing agency, provided that such devices are distinctive in tone and are audible throughout the structure.*

**[F] 907.2.7 Group M.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group M occupancies where one of the following conditions exists:

1. The combined Group M occupant load of all floors is 500 or more persons.
2. The Group M occupant load is more than 100 persons above or below the lowest level of exit discharge.

**Exceptions:**

1. A manual fire alarm system is not required in covered or open mall buildings complying with Section 402.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will automatically activate throughout the notification zones upon sprinkler waterflow.

**[F] 907.2.7.1 Occupant notification.** During times that the building is occupied, the initiation of a signal from a manual fire alarm box or from a waterflow switch shall not be required to activate the alarm notification appliances when an alarm signal is activated at a constantly attended location from which evacuation instructions shall be initiated over an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

**[F] 907.2.8 Group R-1.** Fire alarm systems and smoke alarms shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.

**[F] 907.2.8.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-1 occupancies.

**Exceptions:**

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by at least 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building when all of the following conditions are met:
  - 2.1. The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2;

2.2. The notification appliances will activate upon sprinkler waterflow; and

2.3. At least one manual fire alarm box is installed at an approved location.

**[F] 907.2.8.2 Automatic smoke detection system.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed throughout all interior corridors serving sleeping units.

**Exception:** An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

**[F] 907.2.8.3 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

**[F] 907.2.9 Group R-2 and R-2.1.** Fire alarm systems and smoke alarms shall be installed in Group R-2 and R-2.1 occupancies as required in Sections 907.2.9.1 and 907.9.4.

**[F] 907.2.9.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies where:

1. Any dwelling unit or sleeping unit is located three or more stories above the lowest level of exit discharge;
2. Any dwelling unit or sleeping unit is located more than one story below the highest level of exit discharge of exits serving the dwelling unit or sleeping unit; or
3. The building contains more than 16 dwelling units or sleeping units.
4. *Congregate residences with more than 16 occupants.*

**Exceptions:**

1. A fire alarm system is not required in buildings not more than two stories in height where all dwelling units or sleeping units and contiguous attic and crawl spaces are separated from each other and public or common areas by at least 1-hour fire partitions and each dwelling unit or sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and the occupant notification appliances will automatically activate throughout the notification zones upon a sprinkler waterflow.
3. A fire alarm system is not required in buildings that do not have interior corridors serving

dwelling units and are protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1026.6, Exception 4.

**[F] 907.2.9.2 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

**[F] 907.2.9.3 Group R-2 college and university buildings.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 college and university buildings in the following locations:

1. Common spaces outside of dwelling units and sleeping units.
2. Laundry rooms, mechanical equipment rooms, and storage rooms.
3. All interior corridors serving sleeping units or dwelling units.

Required smoke alarms in dwelling units and sleeping units in Group R-2 college and university buildings shall be interconnected with the fire alarm system in accordance with NFPA 72.

**Exception:** An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units or dwelling units and where each sleeping unit or dwelling unit either has a means of egress door opening directly to an exterior exit access that leads directly to an exit or a means of egress door opening directly to an exit.

**907.2.9.4 Licensed Group R-2.1 occupancies.** *Licensed Group R-2.1 occupancies housing more than six nonambulatory, elderly clients shall be provided with an approved manual and automatic fire alarm system.*

**Exceptions:** *Buildings housing nonambulatory clients on the first story only and which are protected throughout by the following:*

1. *An approved and supervised automatic sprinkler system, as specified in Sections 903.3.1.1 or 903.3.1.2, which upon activation will initiate the fire alarm system to notify all occupants.*
2. *A manual fire alarm system.*
3. *Smoke alarms required by Section 907.2.11.*

**[F] 907.2.10 Group R-4.** Fire alarm systems and smoke alarms shall be installed in Group R-4 occupancies as required in Sections 907.2.10.1 through 907.2.10.3.

**[F] 907.2.10.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-4 occupancies.

**Exceptions:**

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by at least 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building when the following conditions are met:
  - 2.1. The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2;
  - 2.2. The notification appliances will activate upon sprinkler waterflow; and
  - 2.3. At least one manual fire alarm box is installed at an approved location.
3. Manual fire alarm boxes in resident or patient sleeping areas shall not be required at exits where located at all nurses' control stations or other constantly attended staff locations, provided such stations are visible and continuously accessible and that travel distances required in Section 907.4.2.1 are not exceeded.

**[F] 907.2.10.2 Automatic smoke detection system.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in corridors, waiting areas open to corridors and habitable spaces other than sleeping units and kitchens.

**Exceptions:**

1. Smoke detection in habitable spaces is not required where the facility is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

**[F] 907.2.10.3 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

**[F] 907.2.11 Single- and multiple-station smoke alarms.** Listed single- and multiple-station smoke alarms comply-

ing with UL 217 shall be installed in accordance with Sections 907.2.11.1 through 907.2.11.4 and NFPA 72.

**Exception:** For Group R occupancies. A fire alarm system with smoke detectors located in accordance with this section may be installed in lieu of smoke alarms. Upon actuation of the detector, only those notification appliances in the dwelling unit or guest room where the detector is actuated shall activate.

**[F] 907.2.11.1 Group R-1.** Single- or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1:

1. In sleeping areas.
2. In every room in the path of the means of egress from the sleeping area to the door leading from the sleeping unit.
3. In each story within the sleeping unit, including basements. For sleeping units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

See Section 907.2.11.5 for specific location requirements.

**[F] 907.2.11.2 Groups R-2, R-2.1, R-3, R-3.1 and R-4 and I-1.** Single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-2.1, R-3, R-3.1 and R-4 regardless of occupant load at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.

**Exception:** Single- or multiple-station smoke alarms in Group I-1 shall not be required where smoke detectors are provided in the sleeping rooms as part of an automatic smoke detection system.

3. In each story within a dwelling unit, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
4. In a Group R-3.1 occupancies, in addition to the above, smoke alarms shall be provided throughout the habitable areas of the dwelling unit except kitchens.

See Section 907.2.11.5 for specific location requirements.

**907.2.11.2.1 Group I-4 occupancies.** Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms.

**907.2.11.2.2 Group R-3.1.** In all facilities housing a bedridden client, smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms shall be electrically interconnected so as to cause all smoke alarms to sound a distinctive alarm signal upon actuation of any single smoke alarm. Such alarm signal shall be audible throughout the facility at a minimal level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel, or be electrically supervised or provided with emergency power.

**907.2.11.2.3 Smoke alarms.** Smoke alarms shall be tested and maintained in accordance with the manufacturer's instructions. Smoke alarms that no longer function shall be replaced. Smoke alarms installed in one- and two-family dwellings shall be replaced after 10 years from the date of manufacture marked on the unit, or if the date of manufacture cannot be determined.

**907.2.11.2.4 Conventional ionization smoke alarms.** Conventional ionization smoke alarms that are solely battery powered shall be equipped with a ten-year battery and have a silence feature.

Conventional ionization smoke alarm for the purposes of this section is a smoke alarm, listed as complying with ANSI/UL 217, in which the only sensing element is an ionization sensor. The output signal from the ionization sensor must exceed a factory set alarm threshold, without the use discriminating algorithms, to determine when an alarm signal is warranted.

#### **907.2.11.5 Specific location requirements.**

Extract from NFPA 72 Section 29.8.3.4 Specific Location Requirements\*.

This extract has been provided by NFPA as amended by the Office of the State Fire Marshal and adopted by reference as follows:

**29.8.3.4 Specific location requirements.** The installation of smoke alarms and smoke detectors shall comply with the following requirements:

- (1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.
- (2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or

*in other spaces where temperatures can fall below 40°F (4°C) or exceed 100°F (38°C).*

- (3) *Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.*
- (4) *Smoke alarms or smoke detectors shall be installed a minimum of 20 feet horizontal distance from a permanently installed cooking appliance.*

#### **Exceptions:**

- (1) *Ionization smoke alarms with an alarm-silencing switch or photoelectric smoke alarms shall be permitted to be installed 10 feet (3 m) or greater from a permanently installed cooking appliance.*
- (2) *Photoelectric smoke alarms shall be permitted to be installed greater than 6 feet (1.8 m) from a permanently installed cooking appliance where the kitchen or cooking area and adjacent spaces have no clear interior partitions and the 10 ft distances would prohibit the placement of a smoke alarm or smoke detector required by other sections of the code.*
- (3) *Smoke alarms listed for use in close proximity to a permanently installed cooking appliance.*
- (5) *Installation near bathrooms. Smoke alarms shall be installed not less than a 3-foot (0.91 m) horizontal distance from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by other sections of the code.*
- (6) *Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers.*
- (7) *Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan.*
- (8) *Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.*
- (9) *For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.*

- (10) *For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 in. (300 mm) vertically down from the highest point.*

- (11) *Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4.*

- (12) *Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3.*

*\*For additional requirements or clarification see NFPA 72.*

**[F] 907.2.11.3 Interconnection.** Where more than one smoke alarm is required to be installed within an individual dwelling unit or sleeping unit in Group R occupancies, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

**[F] 907.2.11.4 Power source.** In new construction, and in newly classified Group R-3.1 occupancies, required smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

**Exception:** Smoke alarms are not required to be equipped with battery backup where they are connected to an emergency electrical system.

**907.2.11.6 Existing Group R Occupancies.** See the California Residential Code for existing Group R-3 occupancies or Chapter 46 of the California Fire Code for all other existing Group R occupancies.

**[F] 907.2.12 Special amusement buildings.** An automatic smoke detection system shall be provided in special amusement buildings in accordance with Sections 907.2.12.1 through 907.2.12.3.

**[F] 907.2.12.1 Alarm.** Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately activate an audible and visible alarm at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements in Section 907.2.12.2.

**[F] 907.2.12.2 System response.** The activation of two or more smoke detectors, a single smoke detector equipped with an alarm verification feature, the auto-

matic sprinkler system or other approved fire detection device shall automatically:

1. Cause illumination of the means of egress with light of not less than 1 footcandle (11 lux) at the walking surface level;
2. Stop any conflicting or confusing sounds and visual distractions;
3. Activate an approved directional exit marking that will become apparent in an emergency; and
4. Activate a prerecorded message, audible throughout the special amusement building, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound which is distinctive from other sounds used during normal operation.

**[F] 907.2.12.3 Emergency voice/alarm communication system.** An emergency voice/alarm communication system, which is also allowed to serve as a public address system, shall be installed in accordance with Section 907.5.2.2 and be audible throughout the entire special amusement building.

**[F] 907.2.13 High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of the fire department vehicle access.** High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be provided with an automatic smoke detection system in accordance with Section 907.2.13.1, a fire department communication system in accordance with Section 907.2.13.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

**Exceptions:**

1. Airport traffic control towers in accordance with Sections 907.2.22 and 412.
2. Open parking garages in accordance with Section 406.5.
3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1.
4. Low-hazard special occupancies in accordance
5. In Group I-2 and R-2.1 occupancies, the alarm shall sound at a constantly attended location and occupant notification shall be broadcast by the emergency voice/alarm communication system.

**[F] 907.2.13.1 Automatic smoke detection.** Automatic smoke detection in high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be in accordance with Sections 907.2.13.1.1 and 907.2.13.1.2.

**[F] 907.2.13.1.1 Area smoke detection.** Area smoke detectors shall be provided in accordance with this section. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by this section shall

activate the emergency voice/alarm communication system in accordance with Section 907.5.2.2. In addition to smoke detectors required by Sections 907.2.1 through 907.2.10, smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room which is not provided with sprinkler protection.
2. In each elevator machine room and in elevator lobbies.

**[M] 907.2.13.1.2 Duct smoke detection.** Smoke detectors listed for use in air duct systems shall be provided in accordance with this section and the California Mechanical Code. The activation of any detector required by this section shall initiate a visible and audible supervisory signal at a constantly attended location. Duct smoke detectors complying with Section 907.3.1 shall be located as follows:

1. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute (cfm) (0.94 m<sup>3</sup>/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.
2. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies, a smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m<sup>3</sup>/s) and serving not more than 10 air-inlet openings.

**[F] 907.2.13.2 Fire department communication system.** Where a wired communication system is approved in lieu of an emergency responder radio coverage system in accordance with Section 510 of the California Fire Code, the wired fire department communication system shall be designed and installed in accordance with NFPA 72 and shall operate between a fire command center complying with Section 911, elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The fire department communication device shall be provided at each floor level within the enclosed exit stairway.

**[F] 907.2.14 Atriums connecting more than two stories.** A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories, with smoke detection installed throughout the atrium. The system shall be activated in accordance with Section 907.5. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.5.2.2.

**[F] 907.2.15 High-piled combustible storage areas.** An automatic smoke detection system shall be installed

throughout high-piled combustible storage areas where required by Section 3206.5 of the *California Fire Code*.

**[F] 907.2.16 Aerosol storage uses.** Aerosol storage rooms and general-purpose warehouses containing aerosols shall be provided with an approved manual fire alarm system where required by the *California Fire Code*.

**[F] 907.2.17 Lumber, wood structural panel and veneer mills.** Lumber, wood structural panel and veneer mills shall be provided with a manual fire alarm system.

**[F] 907.2.18 Underground buildings with smoke control systems.** Where a smoke control system is installed in an underground building in accordance with this code, automatic smoke detectors shall be provided in accordance with Section 907.2.18.1.

**[F] 907.2.18.1 Smoke detectors.** A minimum of one smoke detector listed for the intended purpose shall be installed in the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one story and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m<sup>3</sup>/s) and serving not more than 10 air-inlet openings.

**[F] 907.2.18.2 Alarm required.** Activation of the smoke control system shall activate an audible alarm at a constantly attended location.

**[F] 907.2.19 Deep underground buildings.** Where the lowest level of a structure is more than 60 feet (18 288 mm) below the finished floor of the lowest level of exit discharge, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

**[F] 907.2.20 Covered and open mall buildings.** Where the total floor area exceeds 50,000 square feet (4645 m<sup>2</sup>) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/alarm communication system shall be provided. Emergency voice/alarm communication systems serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with Section 907.5.2.2.

**[F] 907.2.21 Residential aircraft hangars.** A minimum of one single-station smoke alarm shall be installed within a residential aircraft hangar as defined in Chapter 2 and shall be interconnected into the residential smoke alarm or

other sounding device to provide an alarm which will be audible in all sleeping areas of the dwelling.

**[F] 907.2.22 Airport traffic control towers.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in airport control towers in all occupiable and equipment spaces.

**Exception:** Audible appliances shall not be installed within the control tower cab.

**[F] 907.2.23 Battery rooms.** An automatic smoke detection system shall be installed in areas containing stationary storage battery systems with a liquid capacity of more than 50 gallons (189 L).

**907.2.24 Motion picture and television production studio sound stages and approved production facilities.**

**907.2.24.1 Sound stages-solid-ceiling sets and platforms.** Where required by Chapter 48 of the *California Fire Code*, all interior solid-ceiling sets over 600 square feet (55.7m<sup>2</sup>) in area, and platforms (when provided) over 600 square feet (55.7 m<sup>2</sup>) in area and which exceed 3 feet (914 mm) in height shall be protected by an approved heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer's installation instructions. The fire alarm system shall be connected to an approved supervising station in accordance with Section 907.6.5 or a local alarm which will give an audible signal at a constantly attended location.

**907.2.24.2 Production locations-solid-ceiling sets and platforms.** Where required by Chapter 48 of the *California Fire Code* in buildings with existing fire protection systems and where production intends to construct solid-ceiling sets over 600 square feet (55.7 m<sup>2</sup>) in area, and platforms over 600 square feet (55.7 m<sup>2</sup>) in area and which exceed 3 feet (914 mm) in height shall be protected by an approved heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer's installation instructions. The fire alarm system shall be connected to an approved supervising station in accordance with Section 907.6.5 or a local alarm which will give an audible signal at a constantly attended location.

**907.2.24.3 Fire alarm control units.** Fire alarm control units shall be California State Fire Marshal listed and shall be utilized in accordance with their listing. Control units are permitted to be temporarily supported by sets, platforms or pedestals.

**907.2.24.4 Heat detectors.**

**907.2.24.4.1 Heat detection required by this section** shall be defined as a portable system as it is intended to be reinstalled when platforms or sets are changed.

**907.2.24.4.2 Heat detectors shall be secured to standard outlet boxes and are allowed to be temporarily supported by sets, platforms or pedestals.**



**907.2.24.4.3** Heat detectors shall be provided for solid-ceiling sets and platforms where required by Sections 4805.3 and 4811.14.

**907.2.25 Group C occupancies (organized camps).**

**907.2.25.1 General.** Every building and structure used or intended for sleeping purposes shall be provided with an automatic smoke-detection system.

**Exceptions:**

1. Buildings and structures in existence and in operation prior to January 1, 1985.
2. Tents, tent structures and buildings and structures that do not exceed 25 ft (7620 mm) in any lateral dimensions and where such building or structure is not more than one story.

**907.2.25.2 Camp fire alarm.** Every organized camp shall provide and maintain audible appliances, or devices suitable for sounding a fire alarm. Such audible appliances or devices may be of any type acceptable to the enforcing agency provided they are distinctive in tone from all other signaling devices or systems and shall be audible throughout the camp premises. When an automatic fire alarm system is provided, as required by Section 440.6.6 of the California Building Code, all audible appliances required by this section shall be of the same type as that used in the automatic system.

**907.2.26 Fixed guideway transits systems fire alarm and communication systems.**

**907.2.26.1 General.** Every fixed guideway transit station shall be provided with an approved emergency voice/alarm communication system in accordance with NFPA 72. The emergency voice/alarm communication system, designed and installed so that damage to any one speaker will not render any paging zone of the system inoperative.

**Exception:** Open stations

**907.2.26.2 System components.** Each station fire alarm system shall consist of:

1. Fire alarm control unit at a location as permitted by the enforcing agency.
2. An alarm annunciator(s). The annunciator(s) shall be located at a point acceptable to the enforcing agency. The annunciator(s) shall indicate the type of device and general location of alarm. All alarm, supervisory and trouble signals shall be transmitted to the local annunciator(s) and the operations control center.
3. Manual fire alarm boxes shall be provided throughout passenger platforms and stations.

**Exception:** Two-way emergency communication reporting devices (emergency telephones) are allowed to be used in lieu of manual fire alarm boxes as permitted by the enforcing agency. Such devices shall provide two-way communication between the operations control center and each

device. Such devices shall be located as required for manual fire alarm boxes, and shall be distinctly identified by signs, coloring or other means acceptable to the enforcing agency.

4. Automatic smoke detectors in all ancillary spaces.

**Exceptions:**

1. Ancillary spaces protected by an approved fixed automatic extinguishing system; or
2. Ancillary spaces protected by quickresponse sprinklers.
5. Automatic control of exiting components.

**907.2.26.3 Emergency voice/alarm communication system.** Each station shall be provided with an emergency voice/alarm communication system capable of transmitting voice, recorded or electronically generated textual messages to all areas of the station. The system(s) shall be configured such that the messages can be initiated from either the Emergency Management Panel (EMP) or the operations control center.

**907.2.26.4 Emergency telephones.** A dedicated two-way emergency communication phone system designed and installed in accordance with NFPA 72 shall be provided in all underground stations to facilitate direct communications for emergency response between remote locations and the EMP.

**907.2.26.4.1** Remote emergency phones shall be located at ends of station platforms, each hose outlet connection and station valve rooms.

**907.2.26.4.2** Provisions shall be made in the design of this two-way emergency communication phone system for extensions of the system to the next passenger station or guideway portal.

**907.2.27 Winery caves.** An approved manual fire alarm system conforming to the provisions of Section 907.2 shall be provided in all Type 3 winery caves.

**907.2.28 Group L.** A manual fire alarm system shall be installed throughout buildings containing Group L occupancies. When Group L occupancies are located in mixed use buildings, at least one manual fire alarm shall be located in the Group L occupancy.

**907.2.28.1 Group L occupancies located above the 10th story.** Manual fire alarm boxes shall be required on each side of the 2-hour fire-smoke barrier and at each exit above the 10th story.

**907.2.29 Public school state funded construction projects for kindergarten through 12th grade - automatic fire alarm system requirements.**

**907.2.29.1 New public school campus.** An automatic fire alarm system shall be provided in all occupancies. The provisions of this section shall apply to any public school project consisting of one or more buildings on a new school campus and receiving state funds pursuant to Leroy F. Greene School Facilities Act of 1998, California Education Code Sections 17070.10 through

17079. For purposes of this section, new campus refers to a school site, where an application for construction of original buildings was made to DSA on or after July 1, 2002.

**Exceptions:**

1. A relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. Also see CCR, Title 24, Part 1, California Administrative Code, Section 4-314 for definition of relocatable building.
2. Detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:

Concession stand  
Press box  
Restroom facilities  
Shade structure  
Snack bar  
Storage building  
Ticket booth

**907.2.29.2 New building on an existing public school campus.** An automatic fire alarm system shall be provided in all occupancies. The provisions of this section shall apply to any public school project construction of a new building on an existing campus and receiving state funds pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079. For purposes of this section, an existing campus refers to a school site, where an application for construction of original buildings was made to DSA prior to July 1, 2002.

**Exceptions:**

1. A construction project that has an estimated total cost of less than \$200,000.
2. A relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. See California Administrative Code, Section 4-314 for definition of relocatable building.
3. Detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:

Concession stand  
Press box  
Restroom facilities  
Shade structure  
Snack bar  
Storage building  
Ticket booth

**907.2.29.3 Alterations to existing buildings on an existing public school campus.** An automatic fire alarm system shall be provided for all portions within the scope of an alteration project. The provisions of this section shall apply to any public school project on an existing campus and receiving state funds pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079. For purposes of this section, an existing campus refers to a school site, where an application for construction of original buildings was made to DSA prior to July 1, 2002.

**Exceptions:**

1. A construction project that has an estimated total cost of less than \$200,000.
2. A relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. See California Administrative Code, Section 4-314 for definition of relocatable building.
3. Detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:

Storage building  
Ticket booth  
Concession stand  
Snack bar  
Restroom facilities  
Shade structure  
Press box

**907.2.29.4 Day-care, Group E or Group I-4 located on a public school campus.** An automatic fire alarm system shall be provided in all buildings used as or containing a Group E or Group I-4 day-care.

**[F] 907.3 Fire safety functions.** Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control unit where a fire alarm system is installed. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly attended location. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72.

**[F] 907.3.1 Duct smoke detectors.** Smoke detectors installed in ducts shall be listed for the air velocity, temperature and humidity present in the duct. Duct smoke detectors shall be connected to the building's fire alarm control unit when a fire alarm system is required by Section 907.2. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location and shall perform the intended fire safety function in accordance with this code and the California

*Mechanical Code.* Duct smoke detectors shall not be used as a substitute for required open area detection.

**Exceptions:**

1. The supervisory signal at a constantly attended location is not required where duct smoke detectors activate the building's alarm notification appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

**[F] 907.3.2 Delayed egress locks.** Where delayed egress locks are installed on means of egress doors in accordance with Section 1008.1.9.7, an automatic smoke system shall be installed as required by that section.

*907.3.2.1 In other than Groups I, R-2.1 and R-4 occupancies for single-story building, smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces. For multiple-story buildings, smoke detectors shall be installed throughout all occupied areas and mechanical/electrical spaces for the story where delayed egress devices are installed. Additional detectors are required on adjacent stories where occupants of those stories utilize the same means of egress.*

**Exception:** Refer to Section 907.1.2.4 for Group A courthouse occupancies.

*907.3.2.2 For Group I and R-2.1 occupancies. Smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces of smoke-compartments where delayed egress devices are installed. Additional detectors are required in adjacent smoke-compartments where occupants of those compartments utilize the same means of egress.*

*907.3.2.3 For Group R-4. Occupancies licensed as residential care facilities for the elderly, and housing clients with Alzheimer's disease or dementia residential facilities, smoke detectors shall be installed at ceilings throughout all occupiable rooms and areas and mechanical/ electrical rooms and spaces.*

**[F] 907.3.3 Elevator emergency operation.** Automatic fire detectors installed for elevator emergency operation shall be installed in accordance with the provisions of *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* and NFPA 72.

**[F] 907.3.4 Wiring.** The wiring to the auxiliary devices and equipment used to accomplish the above fire safety functions shall be monitored for integrity in accordance with NFPA 72.

**[F] 907.4 Initiating devices.** Where manual or automatic alarm initiation is required as part of a fire alarm system, the initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

**[F] 907.4.1 Protection of fire alarm control unit.** In areas that are not continuously occupied, a single smoke detector shall be provided at the location of each fire alarm control unit, notification appliance circuit power extenders, and supervising station transmitting equipment.

**Exception:** Where ambient conditions prohibit installation of a smoke detector, a heat detector shall be permitted.

**[F] 907.4.2 Manual fire alarm boxes.** Where a manual fire alarm system is required by another section of this code, it shall be activated by fire alarm boxes installed in accordance with Sections 907.4.2.1 through 907.4.2.6.

**[F] 907.4.2.1 Location.** Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the entrance to each exit. Additional manual fire alarm boxes shall be located so that travel distance to the nearest box does not exceed 200 feet (60 960 mm).

**Exception:** When individual dwelling units are served by a single exit stairway, additional boxes at other than the ground floor may be omitted.

**[F] 907.4.2.2 Height.** The height of the manual fire alarm boxes shall be a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1219 mm) measured vertically, from the floor level to the activating handle or lever of the box. *Manual fire alarm boxes shall also comply with Section 1117B.6, Item 4.*

**Exception:** [DSA-AC] In existing buildings there is no requirement to retroactively relocate existing manual fire alarm boxes to a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1219 mm) from the floor level to the activating handle or lever of the box.

**[F] 907.4.2.3 Color.** Manual fire alarm boxes shall be red in color.

**[F] 907.4.2.4 Signs.** Where fire alarm systems are not monitored by a supervising station, an approved permanent sign shall be installed adjacent to each manual fire alarm box that reads: WHEN ALARM SOUNDS CALL FIRE DEPARTMENT.

**Exception:** Where the manufacturer has permanently provided this information on the manual fire alarm box.

**[F] 907.4.2.5 Protective covers.** The fire code official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local alarm signal shall not be installed unless approved. Protective covers shall not project more than that permitted by Section 1003.3.3.

**[F] 907.4.2.6 Unobstructed and unobscured.** Manual fire alarm boxes shall be accessible, unobstructed, unobscured and visible at all times.

**907.4.2.7 Operation.** *Manual fire alarm boxes shall be operable with one hand including boxes with protective covers.*

**[F] 907.4.3 Automatic smoke detection.** Where an automatic smoke detection system is required it shall utilize smoke detectors unless ambient conditions prohibit such an installation. In spaces where smoke detectors cannot be utilized due to ambient conditions, approved automatic heat detectors shall be permitted.

**[F] 907.4.3.1 Automatic sprinkler system.** For conditions other than specific fire safety functions noted in Section 907.3, in areas where ambient conditions prohibit the installation of smoke detectors, an automatic sprinkler system installed in such areas in accordance with Section 903.3.1.1 or 903.3.1.2 and that is connected to the fire alarm system shall be approved as automatic heat detection.

**[F] 907.5 Occupant notification systems.** A fire alarm system shall annunciate at the fire alarm control unit and shall initiate occupant notification upon activation, in accordance with Sections 907.5.1 through 907.5.2.3.4. Where a fire alarm system is required by another section of this code, it shall be activated by:

1. Automatic fire detectors.
2. Automatic sprinkler system waterflow devices.
3. Manual fire alarm boxes.
4. Automatic fire-extinguishing systems.

**Exception:** Where notification systems are allowed elsewhere in Section 907 to annunciate at a constantly attended location.

**[F] 907.5.1 Presignal feature.** A presignal feature shall not be installed unless approved by the fire code official and the fire department. Where a presignal feature is provided, a signal shall be annunciated at a constantly attended location approved by the fire department, in order that occupant notification can be activated in the event of fire or other emergency.

**[F] 907.5.2 Alarm notification appliances.** Alarm notification appliances shall be provided and shall be listed for their purpose.

**[F] 907.5.2.1 Audible alarms.** Audible alarm notification appliances shall be provided and emit a distinctive sound that is not to be used for any purpose other than that of a fire alarm. *In Group I-2 occupancies, audible appliances located in patient areas shall be only chimes or similar sounding appliances for alerting staff. See Section 907.6.5.*

**Exceptions:**

1. Visible alarm notification appliances shall be allowed in lieu of audible alarm notification appliances in *patient* areas of Group I-2 occupancies.

2. Where provided, audible notification appliances located in each occupant evacuation elevator lobby in accordance with Section 3008.5.1 shall be connected to a separate notification zone for manual paging only.

**[F] 907.5.2.1.1 Average sound pressure.** The audible alarm notification appliances shall provide a sound pressure level of 15 decibels (dBA) above the average ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds, whichever is greater, in every occupiable space within the building.

**[F] 907.5.2.1.2 Maximum sound pressure.** The maximum sound pressure level for audible alarm notification appliances shall be 110 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 95 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

**907.5.2.1.3 Audible alarm signal.** *The audible signal shall be the standard fire alarm evacuation signal, ANSI S3.41 Audible Emergency Evacuation Signal, "three pulse temporal pattern," as described in NFPA 72.*

**Exception:** *The use of the existing evacuation signaling scheme shall be permitted where approved by the enforcing agency.*

**[F] 907.5.2.2 Emergency voice/alarm communication systems.** Emergency voice/alarm communication systems required by this code shall be designed and installed in accordance with NFPA 72. The operation of any automatic fire detector, sprinkler waterflow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions for a general or staged evacuation in accordance with the building's fire safety and evacuation plans required by Section 404 of the *California Fire Code*. In high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access, the system shall operate on a minimum of the alarming floor, the floor above and the floor below. Speakers shall be provided throughout the building by paging zones. At a minimum, paging zones shall be provided as follows:

1. Elevator groups.
2. Exit stairways.
3. Each floor.
4. Areas of refuge as defined in Section 1002.1.

**Exception:** In Group I-2 and R-2.1 occupancies, the alarm shall sound in a constantly attended area and a general occupant notification shall be broadcast over the overhead page.

**[F] 907.5.2.2.1 Manual override.** A manual override for emergency voice communication shall be

provided on a selective and all-call basis for all paging zones.

**[F] 907.5.2.2.2 Live voice messages.** The emergency voice/alarm communication system shall also have the capability to broadcast live voice messages by paging zones on a selective and all-call basis.

**[F] 907.5.2.2.3 Alternate uses.** The emergency voice/alarm communication system shall be allowed to be used for other announcements, provided the manual fire alarm use takes precedence over any other use.

**[F] 907.5.2.2.4 Emergency voice/alarm communication captions.** Where stadiums, arenas and grandstands are required to caption audible public announcements in accordance with Section 1108.2.7.2, the emergency/voice alarm communication system shall also be captioned. Prerecorded or live emergency captions shall be from an approved location constantly attended by personnel trained to respond to an emergency.

**[F] 907.5.2.2.5 Emergency power.** Emergency voice/alarm communications systems shall be provided with an approved emergency power source.

**[F] 907.5.2.3 Visible alarms.** Visible alarm notification appliances shall be provided in accordance with Sections 907.5.2.3.1 through 907.5.2.3.5.

**Exceptions:**

1. *In other than Group I-2 and I-2.1*, visible alarm notification appliances are not required in alterations, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.
2. Visible alarm notification appliances shall not be required in *enclosed exit stairways, exterior exit stairs and exterior exit ramps*.
3. Visible alarm notification appliances shall not be required in elevator cars.

**[F] 907.5.2.3.1 Public and common use areas.** Visible alarm notification appliances shall be provided in public use areas and common use areas, *including but not limited to:*

1. *Sanitary facilities including restrooms, bathrooms and shower rooms*
2. *Corridors*
3. *Music practice rooms*
4. *Band rooms*
5. *Gymnasiums*
6. *Multipurpose rooms*
7. *Occupational shops*
8. *Occupied rooms where ambient noise impairs hearing of the fire alarm*
9. *Lobbies*

*10. Meeting rooms*

*11. Classrooms*

**[F] 907.5.2.3.2 Employee work areas.** Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with a minimum of 20-percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing impaired employee(s).

**[F] 907.5.2.3.3 Groups R-1 and R-2.1.** Group R-1 and R-2.1 dwelling units or sleeping units in accordance with Table 907.5.2.3.3 shall be provided with a visible alarm notification appliance, activated by both the in-room smoke alarm and the building fire alarm system.

**[F] TABLE 907.5.2.3.3  
VISIBLE ALARMS**

NUMBER OF SLEEP UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
6 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

*[SFM] Also see Chapter 11B, Section 11B-224.4 and Table 11B-224.4.*

**[F] 907.5.2.3.4 Group R-2.** In Group R-2 occupancies required by Section 907 to have a fire alarm system, all dwelling units and sleeping units shall be provided with the capability to support visible alarm notification appliances in accordance with NFPA 72. Such capability shall be permitted to include the potential for future interconnection of the building fire alarm system with the unit smoke alarms, replacement of audible appliances with combination audible/visible appliances, or future extension of the existing wiring from the unit smoke alarm locations to required locations for visible appliances.

**907.5.2.3.5 Groups R-2.1, R-3.1 and R-4.** *Protective social care facilities which house persons who are hearing impaired, shall be provided with notification appliances for the hearing impaired installed in accordance with NFPA 72 and which shall activated upon initiation of the fire alarm system or the smoke alarms.*

**907.5.2.4 Group E schools.** *One audible alarm notification appliance shall be mounted on the exterior of a buildings to alert occupants at each playground area.*

**907.5.2.5 Groups I-2 and 1-2.1.** Audible appliances shall be used in nonpatient areas. Visible appliances are allowed to be used in lieu of audible appliances in patient occupied areas. Audible appliances located in patient areas shall be only chimes or similar sounding appliances for alerting staff.

In occupancies housing nonambulatory persons where restraint is practiced, staff and attendants shall be provided and housed or located in such a manner that such supervisory personnel will also be alerted upon activation of the fire alarm system or any detector required by this section.

**[F] 907.6 Installation.** A fire alarm system shall be installed in accordance with this section and NFPA 72.

**[F] 907.6.1 Wiring.** Wiring shall comply with the requirements of California Electrical Code and NFPA 72. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72.

**907.6.1.1 High-rise buildings.** Wiring for fire alarm signaling line circuits, initiating circuits and notification circuits in high-rise buildings shall be in accordance with the following:

1. Class A in accordance with NFPA 72.

**Exception:** Initiating circuits which serve only a single initiating device.

2. Enclosed in continuous metallic raceways in accordance with the California Electrical Code.

**Exception:** Metallic cable (MC) shall be permitted for fire alarm notification circuits where continuous metallic raceways are not required for survivability.

**[F] 907.6.2 Power supply.** The primary and secondary power supply for the fire alarm system shall be provided in accordance with NFPA 72.

**Exception:** Back-up power for single-station and multiple-station smoke alarms as required in Section 907.2.11.4.

**[F] 907.6.3 Zones.** Fire alarm systems shall be divided into zones where required by this section. For the purposes of annunciation and notification, zoning shall be in accordance with the following:

1. Where the fire-protective signaling system serves more than one building, each building shall be considered as a separate zone.
2. Each floor of a building shall be considered as a separate zone.
3. Each section of floor of a building that is separated by fire walls or by horizontal exits shall be considered as a separate zone.
4. Each zone shall not exceed 22,500 square feet (2090 m<sup>2</sup>). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

**Exception:** Automatic sprinkler system zones shall not exceed the area permitted by NFPA 13.

5. For Group I-3 occupancies each cell complex shall be considered a separate zone.
6. For Group H and L occupancies above the 10th story, each side of the 2-hour fire-smoke barrier shall be considered a separate zone.
7. Annunciation shall be further divided into zones where deemed necessary by the enforcing agency.

**907.6.3.1 Annunciation.** Alarm, supervisory and trouble signals shall be annunciated in the main control unit by means of an audible signal and a visual display in accordance with NFPA 72. Identification of the type of alarm and supervisory initiating devices, such as manual, automatic, sprinkler waterflow, sprinkler valve supervisory, fire-pump supervisory, etc., shall be separately indicated.

**Exception:** Group R-3 occupancies.

**[F] 907.6.3.1.1 Annunciator panel.** An annunciator panel complying with Section 907.6.3.1 and the associated controls shall be provided in an approved remote location where deemed necessary by the enforcing agency. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible-alarm silencing switch.

**[F] 907.6.3.2 High-rise buildings.** In high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler waterflow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire detection devices or suppression systems.

**907.6.3.3 High-rise buildings zoning annunciator panel.** In high-rise buildings, a zoning annunciator panel shall be provided in the Fire Command Center. This panel shall not be combined with the Firefighter Smoke Control Panel unless approved. Panel shall be in matrix format or an approved equivalent configuration. All indicators shall be based upon positive confirmation. The panel shall include the following features at a minimum:

1. Fire alarm initiating devices with individual annunciation per floor for manual fire alarm boxes, area smoke detectors, elevator lobby smoke detectors, duct smoke detectors, heat detectors, auxiliary alarms and sprinkler waterflow. (Red LED)
2. Sprinkler and standpipe system control valves per floor - supervisory. (Yellow LED)

3. *Common fire alarm system trouble. (Yellow LED)*
4. *Annunciation Panel Power On. (Green LED)*
5. *Lamp test. (Push Button)*

**907.6.3.4 Notification zoning.** Upon activation of initiating devices where occupant notification is required for evacuation, all notification zones shall operate simultaneously throughout the building.

**Exceptions:**

1. *High-rise buildings as permitted in Section 907.2.12.2,*
2. *Hospitals and convalescent facilities with staff alerting notification appliances or emergency voice/alarm communication, zoning shall be in accordance with the approved fire plan.*
3. *Detention facilities.*
4. *Upon approval by the fire code official in buildings which are sprinklered throughout, specific notification zoning shall be permitted where the notification zones are separated by a minimum of a 2-hour fire barrier and 2-hour fire-resistive floor assembly. The system shall have the capability to activate all other notification zones by automatic and manual means.*
5. *Upon approval by the fire code official in buildings which are sprinklered throughout, specific notification zoning shall be permitted where the activated initiating device or fire extinguishing system is separated from any nonactive notification zones by a minimum of 300-ft horizontal distance. The system shall have the capability to activate all other notification zones by automatic and manual means.*
6. *Where a Group H or L occupancy is located above the 10th story, each side of the 2-hour fire-smoke barrier shall be considered a separate zone.*

**[F] 907.6.4 Access.** Access shall be provided to each fire alarm device and notification appliance for periodic inspection, maintenance and testing.

**[F] 907.6.5 Monitoring.** Fire alarm systems required by this chapter or by the *California Fire Code* shall be monitored by an approved supervising station in accordance with NFPA 72.

**Exception:** Monitoring by a supervising station is not required for:

1. *Single- and multiple-station smoke alarms required by Section 907.2.11.*
2. *Group I-3 occupancies shall be monitored in accordance with Section 907.2.6.3.*
3. *Automatic sprinkler systems in one- and two-family dwellings.*

**[F] 907.6.5.1 Automatic telephone-dialing devices.** Automatic telephone-dialing devices used to transmit an emergency alarm shall not be connected to any fire department telephone number unless approved by the fire chief.

**[F] 907.6.5.2 Termination of monitoring service.** Termination of fire alarm monitoring services shall be in accordance with Section 901.9 of the *California Fire Code*.

**907.6.5.3 Group E schools.** Fire alarm systems shall transmit the alarm, supervisory and trouble signals to an approved supervising station in accordance with NFPA 72. The supervising station shall be listed as either UUX (Central Station) or UUXS (remote & proprietary) by the Underwriters Laboratory Inc. (UL) or other approved listing and testing laboratory or shall comply with the requirements of standard, FM 3011.

**[F] 907.7 Acceptance tests and completion.** Upon completion of the installation, the fire alarm system and all fire alarm components shall be tested in accordance with NFPA 72.

**[F] 907.7.1 Single- and multiple-station alarm devices.** When the installation of the alarm devices is complete, each device and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the smoke alarm provisions of NFPA 72.

**[F] 907.7.2 Record of completion.** A record of completion in accordance with NFPA 72 verifying that the system has been installed and tested in accordance with the approved plans and specifications shall be provided.

**[F] 907.7.3 Instructions.** Operating, testing and maintenance instructions and record drawings ("as-builts") and equipment specifications shall be provided at an approved location.

**[F] 907.8 Inspection, testing and maintenance.** The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with Section 907.8 of the *California Fire Code*.

## SECTION 908 EMERGENCY ALARM SYSTEMS

**[F] 908.1 Group H occupancies.** Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with Section 414.7.

**[F] 908.2 Group H-5 occupancy.** Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in Section 415.10.3.5. A continuous gas-detection system shall be provided for HPM gases in accordance with Section 415.10.7.

**[F] 908.3 Highly toxic and toxic materials.** A gas detection system shall be provided to detect the presence of highly toxic or toxic gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is pro-

vided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the immediately dangerous to life and health (IDLH) limit.

**Exception:** A gas-detection system is not required for *toxic* gases when the physiological warning threshold level for the gas is at a level below the accepted PEL for the gas.

**[F] 908.3.1 Alarms.** The gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be both visible and audible and shall provide warning both inside and outside the area where gas is detected. The audible alarm shall be distinct from all other alarms.

**Exception:** Signal transmission to a constantly attended control station is not required when not more than one cylinder of highly toxic or toxic gas is stored.

**[F] 908.3.2 Shutoff of gas supply.** The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected.

**Exception:** Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic compressed gases where such reactors are:

1. Operated at pressures less than 15 pounds per square inch gauge (psig) (103.4 kPa).
2. Constantly attended.
3. Provided with readily accessible emergency shutoff valves.

**[F] 908.3.3 Valve closure.** The automatic closure of shutoff valves shall be in accordance with the following:

1. When the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and compressed gas containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed container of specific gas detected supplying the manifold shall automatically close.

**Exception:** When the gas-detection sampling point initiating the gas-detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close.

**[F] 908.4 Ozone gas-generator rooms.** Ozone gas-generator rooms shall be equipped with a continuous gas-detection system that will shut off the generator and sound a local alarm when concentrations above the PEL occur.

**[F] 908.5 Repair garages.** A flammable-gas detection system shall be provided in repair garages for vehicles fueled by nonodorized gases in accordance with Section 406.8.5.

**[F] 908.6 Refrigerant detector.** Machinery rooms shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values for the refrigerant classification indicated in the *California Mechanical Code*. Detectors and alarms shall be placed in approved locations.

**[F] 908.7 Carbon monoxide alarms.** (See Section 420.6).

## SECTION 909 SMOKE CONTROL SYSTEMS

**[F] 909.1 Scope and purpose.** This section applies to mechanical or passive smoke control systems when they are required by other provisions of this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke- and heat-venting provisions found in Section 910. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *California Mechanical Code*.

**[F] 909.2 General design requirements.** Buildings, structures or parts thereof required by this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

**[F] 909.3 Special inspection and test requirements.** In addition to the ordinary inspection and test requirements which buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particu-



lar testing involved. The special inspections and tests required by this section shall be conducted under the same terms in Section 1704.

**[F] 909.4 Analysis.** A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted construction documents and shall include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.6.

**[F] 909.4.1 Stack effect.** The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used.

**[F] 909.4.2 Temperature effect of fire.** Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities.

**[F] 909.4.3 Wind effect.** The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of Chapter 16.

**[F] 909.4.4 HVAC systems.** The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems.

**[F] 909.4.5 Climate.** The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

**[F] 909.4.6 Duration of operation.** All portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is less.

**[F] 909.5 Smoke barrier construction.** Smoke barriers shall comply with Section 710, and shall be constructed and sealed to limit leakage areas exclusive of protected openings. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls  $A/A_w = 0.00100$
2. Interior exit stairways and ramps and exit passageways:  $A/A_w = 0.00035$
3. Enclosed exit access stairways and ramps and all other shafts:  $A/A_w = 0.00150$
4. Floors and roofs:  $A/A_F = 0.00050$

where:

$A$  = Total leakage area, square feet ( $m^2$ ).

$A_F$  = Unit floor or roof area of barrier, square feet ( $m^2$ ).

$A_w$  = Unit wall area of barrier, square feet ( $m^2$ ).

The leakage area ratios shown do not include openings due to doors, operable windows or similar gaps. These shall be included in calculating the total leakage area.

**[F] 909.5.1 Leakage area.** The total leakage area of the barrier is the product of the smoke barrier gross area multiplied by the allowable leakage area ratio, plus the area of other openings such as gaps and operable windows. Compliance shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems. Passive smoke control systems tested using other approved means such as door fan testing shall be as approved by the fire code official.

**[F] 909.5.2 Opening protection.** Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by fire door assemblies complying with Section 716.5.3.

#### Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with Section 907.3.
2. Fixed openings between smoke zones that are protected utilizing the airflow method *in other than Group I-2*.
3. In Group I-2, where such doors are installed across corridors, a pair of opposite-swinging doors without a center mullion *or horizontal sliding doors that comply with Section 1008.1.4.3 shall be installed. Vision panels consisting of fire-rated glazing in approved frames shall be provided in each cross-corridor swinging door and at each cross-corridor horizontal-sliding door in a smoke barrier.* The doors shall be close-fitting within operational tolerances and shall not have undercuts, louvers or grilles. *Swinging doors shall have head and jamb stops, astragals or rabbets at meeting edges. Doors installed across corridors shall be automatic-closing by smoke detection in accordance with Section 715.4.8.3. Positive-latching devices are not required. Doors installed across corridors shall comply with Section 1008.11.1.*
4. Group I-3.
5. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.
6. *In Group I-2, smoke damper activation may be accomplished by a fire alarm control unit provided that an open area smoke detection system is provided within all areas served by an HVAC system.*

**[F] 909.5.2.1 Ducts and air transfer openings.** Ducts and air transfer openings are required to be protected

with a minimum Class II, 250°F (121°C) smoke damper complying with Section 717.

**[F] 909.6 Pressurization method.** The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

**[F] 909.6.1 Minimum pressure difference.** The minimum pressure difference across a smoke barrier shall be 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences at least two times the maximum calculated pressure difference produced by the design fire.

**[F] 909.6.2 Maximum pressure difference.** The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with Section 1008.1.3. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA\Delta P)/2(W-d) \quad (\text{Equation 9-1})$$

where:

$A$  = Door area, square feet (m<sup>2</sup>).

$d$  = Distance from door handle to latch edge of door, feet (m).

$F$  = Total door opening force, pounds (N).

$F_{dc}$  = Force required to overcome closing device, pounds (N)

$K$  = Coefficient 5.2 (1.0).

$W$  = Door width, feet (m).

$\Delta P$  = Design pressure difference, inches of water (Pa).

**[F] 909.7 Airflow design method.** When approved by the fire code official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects.

**[F] 909.7.1 Velocity.** The minimum average velocity through a fixed opening shall not be less than:

$$v = 217.2[h(T_f - T_o)/(T_f + 460)]^{1/2} \quad (\text{Equation 9-2})$$

$$\text{For SI: } v = 119.9 [h(T_f - T_o)/T_f]^{1/2}$$

where:

$h$  = Height of opening, feet (m).

$T_f$  = Temperature of smoke, °F (K).

$T_o$  = Temperature of ambient air, °F (K).

$v$  = Air velocity, feet per minute (m/minute).

**[F] 909.7.2 Prohibited conditions.** This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. In no case shall airflow toward the fire exceed 200 feet per minute (1.02 m/s). Where the formula in Section 909.7.1 requires airflow to exceed this limit, the airflow method shall not be used.

**[F] 909.8 Exhaust method.** When approved by the fire code official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92.

**[F] 909.8.1 Smoke layer.** The height of the lowest horizontal surface of the smoke layer interface shall be maintained at least 6 feet (1829 mm) above any walking surface that forms a portion of a required egress system within the smoke zone.

**[F] 909.9 Design fire.** The design fire shall be based on a rational analysis performed by the registered design professional and approved by the fire code official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section.

**[F] 909.9.1 Factors considered.** The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

**[F] 909.9.2 Design fire fuel.** Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

**[F] 909.9.3 Heat-release assumptions.** The analysis shall make use of best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

**[F] 909.9.4 Sprinkler effectiveness assumptions.** A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

**[F] 909.10 Equipment.** Equipment including, but not limited to, fans, ducts, automatic dampers and balance dampers, shall be suitable for its intended use, suitable for the probable exposure temperatures that the rational analysis indicates and as approved by the fire code official.

**[F] 909.10.1 Exhaust fans.** Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = (Q_c/mc) + (T_a) \quad (\text{Equation 9-3})$$

where:

$c$  = Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg • K).

$m$  = Exhaust rate, pounds per second (kg/s).

$Q_c$  = Convective heat output of fire, Btu/s (kW).

$T_a$  = Ambient temperature, °F (K).

$T_s$  = Smoke temperature, °F (K).

**Exception:** Reduced  $T_s$  as calculated based on the assurance of adequate dilution air.

**[F] 909.10.2 Ducts.** Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 909.10.1. Ducts shall be constructed and supported in accordance with the *California Mechanical Code*. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

**Exception:** Flexible connections (for the purpose of vibration isolation) complying with the *California Mechanical Code*, that are constructed of approved fire-resistance-rated materials.

**[F] 909.10.3 Equipment, inlets and outlets.** Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

**[F] 909.10.4 Automatic dampers.** Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of approved, recognized standards.

**[F] 909.10.5 Fans.** In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the requirements of Chapter 16. Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts), as determined from measurement of actual current draw, and shall have a minimum service factor of 1.15.

**[F] 909.11 Power systems.** The smoke control system shall be supplied with two sources of power. Primary power shall be from the normal building power systems. Secondary power shall be from an approved standby source complying with Chapter 27 of this code. The standby power source and its transfer switches shall be in a room separate from the normal power transformers and switch gears and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The transfer to full

standby power shall be automatic and within 60 seconds of failure of the primary power.

**[F] 909.11.1 Power sources and power surges.** Elements of the smoke control system relying on volatile memories or the like shall be supplied with uninterruptable power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke control system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

**[F] 909.12 Detection and control systems.** Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment.

Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override, the presence of power downstream of all disconnects and, through a preprogrammed weekly test sequence, report abnormal conditions audibly, visually and by printed report.

*The status of dampers shall be determined using limit or proximity switches installed at the damper or incorporated into the damper actuator. Where multiple dampers are grouped together in an assembly requiring one or more actuators, each damper shall be independently controlled by a separate actuator and provided with an individual limit or proximity switch, or the dampers shall be linked together by a reliable and durable mechanical or otherwise permanent means into one or more groups, with each group provided with a common limit or proximity switch.*

*The status of fans shall be determined by sensing the air flow downstream of the fans using pressure differential switches or transmitters, or by other means of positive proof of air flow where approved by the enforcing authority.*

**[F] 909.12.1 Wiring.** In addition to meeting requirements of *California Electrical Code*, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

**[F] 909.12.2 Activation.** Smoke control systems shall be activated in accordance with this section.

**[F] 909.12.2.1 Pressurization, airflow or exhaust method.** Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

**[F] 909.12.2.2 Passive method.** Passive smoke control systems actuated by approved spot-type detectors listed for releasing service shall be permitted.

**[F] 909.12.3 Automatic control.** Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1, manual controls that are readily accessible to the fire department and any smoke detectors required by engineering analysis.

**[F] 909.13 Control air tubing.** Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

**[F] 909.13.1 Materials.** Control-air tubing shall be hard-drawn copper, Type L, ACR in accordance with ASTM B 42, ASTM B 43, ASTM B 68, ASTM B 88, ASTM B 251 and ASTM B 280. Fittings shall be wrought copper or brass, solder type in accordance with ASME B 16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP-5 brazing alloy with solidus above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

**Exception:** Nonmetallic tubing used within control panels and at the final connection to devices provided all of the following conditions are met:

1. Tubing shall comply with the requirements of *Chapter 6* of the *California Mechanical Code*.
2. Tubing and connected devices shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No.22 gage). Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or teflon or by suitable brass compression to male barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or moveable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing serving devices on doors shall be fastened along hinges.

**[F] 909.13.2 Isolation from other functions.** Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

**[F] 909.13.3 Testing.** Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

**[F] 909.14 Marking and identification.** The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

**[F] 909.15 Control diagrams.** Identical control diagrams showing all devices in the system and identifying their location and function shall be maintained current and kept on file with the fire code official, the fire department and in the fire command center in a format and manner approved by the fire chief.

**[F] 909.16 Fire-fighter's smoke control panel.** A fire-fighter's smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems. The panel shall be located in a fire command center complying with Section 911 in high-rise buildings. *Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access* or buildings with smoke-protected assembly seating. In all other buildings, the fire-fighter's smoke control panel shall be installed in an approved location adjacent to the fire alarm control panel. The fire-fighter's smoke control panel shall comply with Sections 909.16.1 through 909.16.3.

**[F] 909.16.1 Smoke control systems.** Fans within the building shall be shown on the fire-fighter's control panel. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone, and by pilot-lamp-type indicators as follows:

1. Fans, dampers and other operating equipment in their normal status—WHITE.
2. Fans, dampers and other operating equipment in their off or closed status—RED.
3. Fans, dampers and other operating equipment in their on or open status—GREEN.
4. Fans, dampers and other operating equipment in a fault status—YELLOW/AMBER.

**[F] 909.16.2 Smoke control panel.** The fire-fighter's control panel shall provide control capability over the complete smoke-control system equipment within the building as follows:

1. ON-AUTO-OFF control over each individual piece of operating smoke control equipment that can also be controlled from other sources within the building. This includes stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans and other operating equipment used or intended for smoke control purposes.
2. OPEN-AUTO-CLOSE control over individual dampers relating to smoke control and that are also controlled from other sources within the building.
3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire-fighter's control panel.

**Exceptions:**

1. Complex systems, where approved, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where approved, where the control is accomplished by computer interface using approved, plain English commands.

**[F] 909.16.3 Control action and priorities.** The fire-fighter's control panel actions shall be as follows:

1. ON-OFF and OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire-fighter's control panel, no automatic or manual control from any other control point within the building shall contradict the control action. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment (i.e., duct freezestats, duct smoke detectors, high-temperature cut-outs, temperature-actuated linkage and similar devices), such means shall be capable of being overridden by the fire-fighter's control panel. The last control action as indicated by each fire-fighter's control panel switch position shall prevail. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

**Exception:** Power disconnects required by *California Electrical Code*.

2. Only the AUTO position of each three-position fire-fighter's control panel switch shall allow automatic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, nonemergency, building control position. Where a fire-fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described above. When directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

**[F] 909.17 System response time.** Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as dampers and fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts and other equipment. For purposes of smoke control, the fire-fighter's control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

**[F] 909.18 Acceptance testing.** Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of this code, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

**[F] 909.18.1 Detection devices.** Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with Chapter 9 in their installed condition. When applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

**[F] 909.18.2 Ducts.** Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

**[F] 909.18.3 Dampers.** Dampers shall be tested for function in their installed condition.

**[F] 909.18.4 Inlets and outlets.** Inlets and outlets shall be read using generally accepted practices to determine air quantities.

**[F] 909.18.5 Fans.** Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute (rpm) and belt tension shall be made.

**[F] 909.18.6 Smoke barriers.** Measurements using inclined manometers or other approved calibrated measuring devices shall be made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke control condition.

**[F] 909.18.7 Controls.** Each smoke zone equipped with an automatic-initiation device shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire-fighter's control panel and simulation of standby power conditions.

**[F] 909.18.8 Special inspections for smoke control.** Smoke control systems shall be tested by a special inspector.

**[F] 909.18.8.1 Scope of testing.** Special inspections shall be conducted in accordance with the following:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

**[F] 909.18.8.2 Qualifications.** Special inspection agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

**[F] 909.18.8.3 Reports.** A complete report of testing shall be prepared by the special inspector or special inspection agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible registered design professional and, when satisfied that the design intent has been achieved, the responsible registered design professional shall seal, sign and date the report.

**[F] 909.18.8.3.1 Report filing.** A copy of the final report shall be filed with the fire code official and an identical copy shall be maintained in an approved location at the building.

**[F] 909.18.9 Identification and documentation.** Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing its proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by Section 909.18.8.3. Devices shall have an approved identifying tag or mark on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

*An approved operations manual describing the complete operations of the smoke control system and functioning of the firefighters smoke control panel shall be maintained at the fire command center.*

**[F] 909.19 System acceptance.** Buildings, or portions thereof, required by this code to comply with this section shall not be issued a certificate of occupancy until such time that the fire code official determines that the provisions of this section have been fully complied with and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system and a written maintenance program complying with the requirements of Section 909.20.1 of the *California Fire Code* has been submitted and approved by the fire code official.

**Exception:** In buildings of phased construction, a temporary certificate of occupancy, as approved by the fire code official, shall be allowed provided that those portions of the building to be occupied meet the requirements of this section and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

**909.20 Smokeproof enclosures.** Where required by Section 1022.10, a smokeproof enclosure shall be constructed in accordance with this section. A smokeproof enclosure shall consist of an enclosed interior exit stairway that conforms to Section 1022.2 and an open exterior balcony or vestibule meeting the requirements of this section. Where access to the roof is required by the *California Fire Code*, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

**909.20.1 Access.** Access to the stair shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall not be less than the width of the corridor leading to the vestibule *calculated in accordance with Section 1005.1*, but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

**909.20.2 Construction.** The smokeproof enclosure shall be separated from the remainder of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings are not permitted other than the required means of egress doors. The

vestibule shall be separated from the stairway by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The open exterior balcony shall be constructed in accordance with the fire-resistance rating requirements for floor assemblies.

**909.20.2.1 Door closers.** Doors in a smokeproof enclosure shall be self- or automatic closing by actuation of a smoke detector in accordance with Section 716.5.9.3 and shall be installed at the floor-side entrance to the smokeproof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.2.2 Vestibule doors.** Where access to the stairway is by way of a vestibule, the door assembly from the building into the vestibule shall be a 90-minute fire door assembly complying with Section 715.4.4. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating and shall comply with the requirements for a smoke door assembly in accordance with Section 715.4.3. The door shall be installed in accordance with NFPA-105.

**909.20.2.3 Standpipes.** Where access to the stairway is by way of a vestibule, Fire department standpipe connections and valves serving the floor shall be within the vestibule unless otherwise approved by the fire code official. Standpipe connections in vestibules shall be located in such a manner so as not to obstruct egress where hose lines are connected and charged.

**909.20.2.4 Pressure differences.** The minimum pressure differences within the vestibule with the doors closed shall be 0.05-inch water gage (12.44 Pa) positive pressure relative to the fire floor and 0.05-inch water gage (12.44 Pa) negative pressure relative to the exit enclosure. No pressure difference is required relative to a nonfire floor.

**909.20.2.5 Relief vent.** A relief vent capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of such pressurized exit enclosures.

**Exception:** When approved by the enforcing agency, other engineered design methods capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be permitted.

**909.20.3 Natural ventilation alternative.** The provisions of Sections 909.20.3.1 and 909.20.3.3 shall apply to ventilation of smokeproof enclosures by natural means.

**909.20.3.1 Balcony doors.** Where access to the stairway is by way of an open exterior balcony, the door assembly into the enclosure shall be a fire door assembly in accordance with Section 716.5.

**909.20.3.2 Vestibule ventilation.** Where access to the stairway is by way of a vestibule, each vestibule shall

have a minimum net area of 16 square feet (1.5 m<sup>2</sup>) of opening in a wall facing an outer court, yard or public way that is at least 20 feet (6096 mm) in width.

**909.20.4 Mechanical pressurization alternative.** The provisions of Sections 909.20.4.1 through 909.20.3.3 shall apply to ventilation to *pressurization* enclosures by mechanical means.

**909.20.4.1 Pressure differences.** *The pressurization system shall be designed so that the minimum pressure differences provided within the vestibule with the doors closed shall be 0.05-inch water gage (12.44 Pa) positive pressure relative to the fire floor and 0.05-inch water gage (12.44 Pa) negative pressure relative to the exit enclosure. No pressure difference is required relative to a nonfire floor.*

**909.20.4.2 Relief vent.** *A relief vent capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of such pressurized exit stairway enclosures.*

**Exception:** *When approved by the enforcing agency, other engineered design methods capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be permitted.*

**909.20.4.3 Pressurization equipment.** The activation of *pressurization* equipment required Section 909.20.4 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure *and upon activation of the automatic controls required by Section 909.12.3.* When the closing device for the stair shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.4.3.1 Pressurization systems.** Smokeproof enclosure *pressurization* systems shall be independent of other building ventilation systems. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
2. Equipment, control wiring, power wiring and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or

horizontal assemblies constructed in accordance with Section 711, or both.

3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. Control wiring and power wiring utilizing a 2-hour rated cable or cable system.
2. Where encased with not less than 2 inches (51 mm) of concrete.

**909.20.4.3.2 Standby power.** *Pressurization and stair shaft ventilation systems and automatic fire detection systems shall be powered by an approved standby power system conforming to Section 403.4.8 and Chapter 27.*

**909.20.4.3.3 Acceptance and testing.** Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

**909.20.5 Pressurization equipment.** The activation of ventilating equipment required by the alternatives in Sections 909.20.4 and 909.20.5 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stair shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.5.1 Pressurizing systems.** Smokeproof enclosure ventilation systems shall be independent of other building ventilation systems. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
2. Equipment, control wiring, power wiring and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. Control wiring and power wiring utilizing a 2-hour rated cable or cable system.
2. Where encased with not less than 2 inches (51 mm) of concrete.

**909.20.5.2 Standby power.** *Pressurization* and stair shaft ventilation systems and automatic fire detection systems shall be powered by an approved standby power system conforming to Section 403.4.8 and Chapter 27.

**909.20.5.3 Acceptance and testing.** Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

**909.20.6 Ventilating equipment.** The activation of ventilating equipment required by the alternatives in Sections 909.20.4 and 909.20.5 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stair shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.6.1 Ventilation systems.** Smokeproof enclosure ventilation systems shall be independent of other building ventilation systems. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
2. Equipment, control wiring, power wiring and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building,

including other mechanical equipment, by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. Control wiring and power wiring utilizing a 2-hour rated cable or cable system.
2. Where encased with not less than 2 inches (51 mm) of concrete.

**909.20.6.2 Standby power.** Mechanical vestibule and stair shaft ventilation systems and automatic fire detection systems shall be powered by an approved standby power system conforming to Section 403.4.8 and Chapter 27.

**909.20.6.3 Acceptance and testing.** Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

**909.21 Elevator hoistway pressurization alternative.** Where elevator hoistway pressurization is provided in lieu of required enclosed elevator lobbies, the pressurization system shall comply with Sections 909.21.1 through 909.21.11.

**909.21.1 Pressurization requirements.** Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.10 inches of water (25 Pa) and a maximum positive pressure of 0.25 inches of water (67 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all elevator cars at the floor of recall and all hoistway doors on the floor of recall open and all other hoistway doors closed. The opening and closing of hoistway doors at each level must be demonstrated during this test. The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.

**909.21.2 Rational analysis.** A rational analysis complying with Section 909.4 shall be submitted with the construction documents.

**909.21.3 Ducts for system.** Any duct system that is part of the pressurization system shall be protected with the same fire-resistance rating as required for the elevator shaft enclosure.

**909.21.4 Fan system.** The fan system provided for the pressurization system shall be as required by Sections 909.21.4.1 through 909.21.4.4.

**909.21.4.1 Fire resistance.** When located within the building, the fan system that provides the pressurization shall be protected with the same fire-resistance rating required for the elevator shaft enclosure.

**909.21.4.2 Smoke detection.** The fan system shall be equipped with a smoke detector that will automatically shut down the fan system when smoke is detected within the system.



**909.21.4.3 Separate systems.** A separate fan system shall be used for each elevator hoistway.

**909.21.4.4 Fan capacity.** The supply fan shall either be adjustable with a capacity of at least 1,000 cfm (0.4719 m<sup>3</sup>/s) per door, or that specified by a registered design professional to meet the requirements of a designed pressurization system.

**909.21.5 Standby power.** The pressurization system shall be provided with standby power from the same source as other required emergency systems for the building.

**909.21.6 Activation of pressurization system.** The elevator pressurization system shall be activated upon activation of the building fire alarm system or upon activation of the elevator lobby smoke detectors. Where both a building fire alarm system and elevator lobby smoke detectors are present, each shall be independently capable of activating the pressurization system.

**909.21.7 Special inspection.** Special inspection for performance shall be required in accordance with Section 909.18.8. System acceptance shall be in accordance with Section 909.19.

**909.21.8 Marking and identification.** Detection and control systems shall be marked in accordance with Section 909.14.

**909.21.9 Control diagrams.** Control diagrams shall be provided in accordance with Section 909.15.

**909.21.10 Control panel.** A control panel complying with Section 909.16 shall be provided.

**909.21.11 System response time.** Hoistway pressurization systems shall comply with the requirements for smoke control system response time in Section 909.17.

## SECTION 910 SMOKE AND HEAT REMOVAL

**[F] 910.1 General.** Where required by this code or otherwise installed, smoke and heat vents, or mechanical smoke exhaust systems, and draft curtains shall conform to the requirements of this section.

### Exceptions:

1. Frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.
2. *Automatic smoke and heat vents or mechanical smoke exhaust systems are not required within areas of buildings equipped with early suppression fast-response (ESFR) sprinklers unless any of the following conditions exist:*
  - 2.1. *The building is a state institution,*
  - 2.2. *The building is a state-owned or state-occupied building,*
  - 2.3. *The building is any of the applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, or*

*2.4. The area of a Group F-1 or S-1 occupancy protected with the early suppression fast-response (ESFR) sprinklers has an exit access travel distance of more than 250 feet (76 200 mm).*

**[F] 910.2 Where required.** Smoke and heat vents or mechanical smoke exhaust systems shall be installed in the roofs of buildings or portions thereof occupied for the uses set forth in Sections 910.2.1 and 910.2.2.

**Exception:** In occupied portions of a building where the upper surface of the story is not a roof assembly, mechanical smoke exhaust in accordance with Section 910.4 shall be an acceptable alternative.

**[F] 910.2.1 Group F-1 or S-1.** Buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m<sup>2</sup>) in undivided area.

**Exception:** *Group F-1 aircraft manufacturing buildings and Group S-1 aircraft repair hangars.*

**[F] 910.2.2 High-piled combustible storage.** Buildings and portions thereof containing high-piled combustible stock or rack storage in any occupancy group in accordance with Section 413 and the *California Fire Code*.

**[F] 910.3 Design and installation.** The design and installation of smoke and heat vents and draft curtains shall be as specified in Sections 910.3.1 through 910.3.5.2 and Table 910.3.

**[F] 910.3.1 Design.** Smoke and heat vents shall be listed and labeled to indicate compliance with *FM 4430, ICC ES AC 331, or UL 793*.

**[F] 910.3.2 Vent operation.** Smoke and heat vents shall be capable of being operated by approved automatic and manual means. Automatic operation of smoke and heat vents shall conform to the provisions of Sections 910.3.2.1 through 910.3.2.3.

**[F] 910.3.2.1 Gravity-operated drop-out vents.** Automatic smoke and heat vents containing heat-sensitive glazing designed to shrink and drop out of the vent opening when exposed to fire shall fully open within 5 minutes after the vent cavity is exposed to a simulated fire, represented by a time-temperature gradient that reaches an air temperature of 500°F (260°C) within 5 minutes.

**[F] 910.3.2.2 Sprinklered buildings.** Where installed in buildings provided with an approved automatic sprinkler system, smoke and heat vents shall be designed in accordance with Sections 910.3.2.2.1 through 910.3.2.2.3.

**910.3.2.2.1 Automatic operation.** Smoke and heat vents shall be designed to operate automatically.

**910.3.2.2.2 Control mode sprinkler system.** Smoke and heat vents installed in areas of buildings with a control mode sprinkler system shall have operating elements with a higher temperature classification than the automatic fire sprinklers in accordance with NFPA 13.

**910.3.2.2.3 Early suppression fast-response (ESFR) sprinkler system.** Smoke and heat vents

installed in areas of buildings with early suppression fast-response (ESFR) sprinklers shall be equipped with a standard-response operating mechanism with a minimum temperature rating of 360°F (182°C) or 100°F (56°C) above the operating temperature of the sprinklers, whichever is higher.

**[F] 910.3.2.3 Nonsprinklered buildings.** Where installed in buildings not provided with an approved automatic sprinkler system, smoke and heat vents shall operate automatically by actuation of a heat-responsive device rated at between 100°F (38°C) and 220°F (104°C) above ambient.

**Exception:** Gravity-operated drop-out vents complying with Section 910.3.2.1.

**[F] 910.3.3 Vent dimensions.** The effective venting area shall not be less than 16 square feet (1.5 m<sup>2</sup>) with no dimension less than 4 feet (1219 mm), excluding ribs or gutters having a total width not exceeding 6 inches (152 mm).

**[F] 910.3.4 Vent locations.** Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and 10 feet (3048 mm) or more from fire barriers. Vents shall be uniformly located within the roof in the areas of the building where the vents are required to be installed by Section 910.2 with consideration given to roof pitch, draft curtain location, sprinkler location and structural members.

**[F] 910.3.5 Draft curtains.** Where required by Table 910.3, draft curtains shall be installed on the underside of the roof in accordance with this section.

**Exception:** Where areas of buildings are equipped with ESFR sprinklers, draft curtains shall not be provided

within these areas. Draft curtains shall only be provided at the separation between the ESFR sprinklers and the non-ESFR sprinklers.

**[F] 910.3.5.1 Construction.** Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other approved materials which provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.

**[F] 910.3.5.2 Location and depth.** The location and minimum depth of draft curtains shall be in accordance with Table 910.3.

**[F] 910.4 Mechanical smoke exhaust.** Engineered mechanical smoke exhaust systems shall be an acceptable alternate to smoke and heat vents. < |

**[F] 910.4.1 Location.** Exhaust fans shall be uniformly spaced, and the maximum distance between fans shall not be greater than 100 feet (30 480 mm). <

**[F] 910.4.2 Size.** Fans shall have a maximum individual capacity of 30,000 cfm (14.2 m<sup>3</sup>/s). For sprinklered buildings, the aggregate capacity of smoke exhaust fans shall provide a minimum of two complete air changes per hour based on the volume of the building or portions thereof without deduction for any commodity storage. For non-sprinklered buildings the aggregate capacity of smoke exhaust fans shall be determined by the equation: |

$$C = A \times 300 \quad \text{(Equation 9-4)}$$

where:

C = Capacity of mechanical ventilation required, in cubic feet per minute (m<sup>3</sup>/s).

A = Area of roof vents provided in square feet (m<sup>2</sup>) in accordance with Table 910.3.

**[F] TABLE 910.3  
REQUIREMENTS FOR DRAFT CURTAINS AND SMOKE AND HEAT VENTS<sup>a</sup>**

OCCUPANCY GROUP AND COMMODITY CLASSIFICATION	DESIGNATED STORAGE HEIGHT (feet)	MINIMUM DRAFT CURTAIN DEPTH (feet)	MAXIMUM AREA FORMED BY DRAFT CURTAINS (square feet)	VENT-AREA-TO-FLOOR-AREA RATIO <sup>c</sup>	MAXIMUM SPACING OF VENT CENTERS (feet)	MAXIMUM DISTANCE FROM VENTS TO WALL OR DRAFT CURTAIN <sup>b</sup> (feet)
Group F-1 and S-1	—	0.2 × H <sup>d</sup> but ≥ 4	50,000	1:100	120	60
High-piled Storage (see Section 910.2.2) Class I-IV commodities (Option 1)	≤ 20	6	10,000	1:100	100	60
	> 20 ≤ 40	6	8,000	1:75	100	55
High-piled Storage (see Section 910.2.2) Class I-IV commodities (Option 2)	≤ 20	4	3,000	1:75	100	55
	> 20 ≤ 40	4	3,000	1:50	100	50
High-piled Storage (see Section 910.2.2) High-hazard commodities (Option 1)	≤ 20	6	6,000	1:50	100	50
	> 20 ≤ 30	6	6,000	1:40	90	45
High-piled Storage (see Section 910.2.2) High-hazard commodities (Option 2)	≤ 20	4	4,000	1:50	100	50
	> 20 ≤ 30	4	2,000	1:30	75	40

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

- Additional requirements for rack storage heights in excess of those indicated shall be in accordance with Chapter 32 of the *California Fire Code*. For solid-piled storage heights in excess of those indicated, an approved engineered design shall be used.
- Vents adjacent to walls or draft curtains shall be located within a horizontal distance not greater than the maximum distance specified in this column as measured perpendicular to the wall or draft curtain that forms the perimeter of the draft curtained area.
- Where draft curtains are not required, the vent area to floor area ratio shall be calculated based on a minimum draft curtain depth of 6 feet (Option 1).
- "H" is the height of the vent, in feet, above the floor.

**[F] 910.4.3 Operation.** Mechanical smoke exhaust fans shall be automatically activated by the automatic sprinkler system or by heat detectors having operating characteristics equivalent to those described in Section 910.3.2. Individual manual controls of each fan unit shall also be provided.

**[F] 910.4.4 Wiring and control.** Wiring for operation and control of smoke exhaust fans shall be connected ahead of the main disconnect and protected against exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes. Controls shall be located so as to be immediately accessible to the fire service from the exterior of the building and protected against interior fire exposure by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**[F] 910.4.5 Supply air.** Supply air for exhaust fans shall be provided at or near the floor level and shall be sized to provide a minimum of 50 percent of required exhaust. Openings for supply air shall be uniformly distributed around the periphery of the area served.

**[F] 910.4.6 Interlocks.** In combination comfort air-handling/smoke removal systems or independent comfort air-handling systems, fans shall be controlled to shut down in accordance with the approved smoke control sequence.

## SECTION 911 FIRE COMMAND CENTER

**[F] 911.1 General.** Where required by other sections of this code and in all buildings classified as high-rise buildings by this code and *Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access*, a fire command center for fire department operations shall be provided and shall comply with Sections 911.1.1 through 911.1.5.

**[F] 911.1.1 Location and access.** The location and accessibility of the fire command center shall be approved by the fire chief.

**[F] 911.1.2 Separation.** The fire command center shall be separated from the remainder of the building by not less than a 1-hour fire barrier constructed in accordance with Section 707 or horizontal assembly constructed in accordance with Section 711, or both.

**[F] 911.1.3 Size.** The room shall be a minimum of 200 square feet (19 m<sup>2</sup>) with a minimum dimension of 10 feet (3048 mm).

**[F] 911.1.4 Layout approval.** A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation.

**[F] 911.1.5 Required features.** The fire command center shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.

2. The fire department communications system.
3. *Fire alarm system zoning annunciator panel required by Section 907.6.3.3.*
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire-fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking stairway doors simultaneously.
8. Sprinkler valve and waterflow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighting equipment and fire department access and the location of fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.
13. An approved Building Information Card that contains, but is not limited to, the following information:
  - 13.1. General building information that includes: property name, address, the number of floors in the building (above and below grade), use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor), estimated building population (i.e., day, night, weekend);
  - 13.2. Building emergency contact information that includes: a list of the building's emergency contacts (e.g., building manager, building engineer, etc.) and their respective work phone number, cell phone number, e-mail address;
  - 13.3. Building construction information that includes: the type of building construction (e.g., floors, walls, columns, and roof assembly);
  - 13.4. Exit stair information that includes: number of exit stairs in building, each exit stair designation and floors served, location where each exit stair discharges, exit stairs that are pressurized, exit stairs provided with emergency lighting, each exit stair that allows reentry, exit stairs providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers

and respective floors that they serve, location of elevator machine rooms, location of sky lobby, location of freight elevator banks;

- 13.5. Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator, location of natural gas service;
  - 13.6. Fire protection system information that includes: locations of standpipes, location of fire pump room, location of fire department connections, floors protected by automatic sprinklers, location of different types of sprinkler systems installed (e.g., dry, wet, pre-action, etc.); and
  - 13.7. Hazardous material information that includes: location of hazardous material, quantity of hazardous material.
14. Work table.
  15. Generator supervision devices, manual start and transfer features.
  16. Public address system, where specifically required by other sections of this code.
  17. Elevator fire recall switch in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.
  18. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.
  19. A master switch for unlocking elevator lobby doors permitted by Section 1008.1.4.6.

*[SFM] Fire command centers shall not be used for the housing of any boiler, heating unit, generator, combustible storage, or similar hazardous equipment or storage.*

**911.1.6 Ventilation.** *The fire command center shall be provided with an independent ventilation or air-conditioning system.*

## SECTION 912 FIRE DEPARTMENT CONNECTIONS

**[F] 912.1 Installation.** Fire department connections shall be installed in accordance with the NFPA standard applicable to the system design and shall comply with Sections 912.2 through 912.5.

**[F] 912.2 Location.** With respect to hydrants, driveways, buildings and landscaping, fire department connections shall be so located that fire apparatus and hose connected to supply the system will not obstruct access to the buildings for other fire apparatus. The location of fire department connections shall be approved by the fire chief.

**[F] 912.2.1 Visible location.** Fire department connections shall be located on the street side of buildings, fully visible

and recognizable from the street or nearest point of fire department vehicle access or as otherwise approved by the fire chief.

**[F] 912.2.2 Existing buildings.** On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an approved sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" at least 6 inches (152 mm) high and words in letters at least 2 inches (51 mm) high or an arrow to indicate the location. All such signs shall be subject to the approval of the fire code official.

**[F] 912.3 Access.** Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other fixed or moveable object. Access to fire department connections shall be approved by the fire chief.

### Exceptions:

1. *Fences, where provided with an access gate equipped with a sign complying with the legend requirements of Section 912.4 and a means of emergency operation. The gate and the means of emergency operation shall be approved by the fire chief and maintained operational at all times.*
2. *When acceptable to the fire authority having jurisdiction, fire department connections for Group I-3 detention facilities may be located inside all security walls or fences on the property.*

**[F] 912.3.1 Locking fire department connection caps.** The fire code official is authorized to require locking caps on fire department connections for water-based fire protection systems where the responding fire department carries appropriate key wrenches for removal.

**[F] 912.3.2 Clear space around connections.** A working space of not less than 36 inches (762 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to the sides of wall-mounted fire department connections and around the circumference of free-standing fire department connections, except as otherwise required or approved by the fire chief.

**[F] 912.3.3 Physical protection.** Where fire department connections are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Section 312 of the *California Fire Code*.

**[F] 912.4 Signs.** A metal sign with raised letters at least 1 inch (25 mm) in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: AUTOMATIC SPRINKLERS or STANDPIPES or TEST CONNECTION or a combination thereof as applicable. Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.

**[P] 912.5 Backflow protection.** The potable water supply to automatic sprinkler and standpipe systems shall be protected

against backflow as required by the *Health and Safety Code Section 13114.7*.

## SECTION 913 FIRE PUMPS

**[F] 913.1 General.** Where provided, fire pumps shall be installed in accordance with this section and NFPA 20.

**[F] 913.2 Protection against interruption of service.** The fire pump, driver and controller shall be protected in accordance with NFPA 20 against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse conditions.

**913.2.1 Protection of fire pump rooms.** Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

### Exceptions:

1. In other than high-rise buildings, separation by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Separation is not required for fire pumps physically separated in accordance with NFPA 20.

**[F] 913.3 Temperature of pump room.** Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F (5°C).

**[F] 913.3.1 Engine manufacturer's recommendation.** Temperature of the pump room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer. The engine manufacturer's recommendations for oil heaters shall be followed.

**[F] 913.4 Valve supervision.** Where provided, the fire pump suction, discharge and bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:

1. Central-station, proprietary or remote-station signaling service.
2. Local signaling service that will cause the sounding of an audible signal at a constantly attended location.
3. Locking valves open.
4. Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

**[F] 913.4.1 Test outlet valve supervision.** Fire pump test outlet valves shall be supervised in the closed position.

**[F] 913.5 Acceptance test.** Acceptance testing shall be done in accordance with the requirements of NFPA 20.

**913.6 Fire pumps in high-rise buildings.** Engine-driven fire pumps and electric drive fire pumps supplied by generators shall both be provided with an on-premises fuel supply, sufficient for not less than 8-hour full-demand operation at 100 percent of the rated pump capacity in addition to all other required supply demands in accordance with Sections 9.6 and 11.4.2 of NFPA 20 and this section. (Also see Section 604.2.14.1.1 of the *California Fire Code*.)

## SECTION 914 EMERGENCY RESPONDER SAFETY FEATURES

**[F] 914.1 Shaftway markings.** Vertical shafts shall be identified as required by Sections 914.1.1 and 914.1.2.

**[F] 914.1.1 Exterior access to shaftways.** Outside openings accessible to the fire department and that open directly on a hoistway or shaftway communicating between two or more floors in a building shall be plainly marked with the word "SHAFTWAY" in red letters at least 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible from the outside of the building.

**[F] 914.1.2 Interior access to shaftways.** Door or window openings to a hoistway or shaftway from the interior of the building shall be plainly marked with the word "SHAFTWAY" in red letters at least 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible.

**Exception:** Markings shall not be required on shaftway openings that are readily discernible as openings onto a shaftway by the construction or arrangement.

**[F] 914.2 Equipment room identification.** Fire protection equipment shall be identified in an approved manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves or other fire detection, suppression or control elements shall be identified for the use of the fire department. Approved signs required to identify fire protection equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

## SECTION 915 EMERGENCY RESPONDER RADIO COVERAGE

**[F] 915.1 General.** Emergency responder radio coverage shall be provided in all new buildings in accordance with Section 510 of the *California Fire Code*.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 10 – MEANS OF EGRESS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X												
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X	X				X	X		X								
<i>Adopt only those sections that are listed below</i>						X														
<i>Chapter / Section</i>																				
1001.3		X																		
1001.4		X																		
1002.1		X																		
Accessible Means of Egress						X														
Area of Refuge						X														
Exit						X														
Guard (or Guardrail)			X	X	X	X														
Handrail						X														
Public Way						X														
Stair						X														
Stairway						X														
1003.1, not SFM exception						X														
1003.1		X	X	X	X															
1003.1.1									X			X								
1003.1.2										X										
1003.2		X	X	X	X															
1003.3																				
1003.3 Exc.		X																		
1003.3.3.1		X																		
1003.3.4			X	X	X															
1003.5		X	X	X	X															
Table 1004.1.1		X																		
1004.1.1.1		X																		
1004.1.1.2		X																		
1004.1.2.3		X																		
1005.1		X																		
1005.3		X																		
1005.3.1		X																		
1005.3.2		X																		
1005.7.1		X																		
1006.1		X																		
1007.1		X	X	X	X	X														
1007.2			X	X	X	X														
1007.2.1						X														
1007.3			X	X	X	X														
1007.4		X				X														
1007.5			X	X	X	X														

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 10 – MEANS OF EGRESS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X												
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X				X	X		X								
Adopt only those sections that are listed below						X														
Chapter / Section																				
1007.5.1						X														
1007.6						X														
1007.6.1		X	X	X	X	X														
1007.6.2						X														
1007.6.3		X				X														
1007.7						X														
1007.7.1						X														
1007.7.2						X														
1007.8			X	X	X	X														
1007.8.1		X	X	X	X															
1007.8.1.1			X	X	X	X														
1007.8.2		X				X														
1007.9			X	X	X	X														
1007.10						X														
1007.11						X														
1007.12		X	X	X	X	X														
1008 (1st paragraph below title only)						X														
1008.1.1		X	X	X	X															
1008.1.1.1		X																		
1008.1.2		X																		
1008.1.4.1			X	X	X															
1008.1.4.4		X																		
1008.1.5			X	X	X															
1008.1.7			X	X	X															
1008.1.8			X	X	X															
1008.1.9.1		X	X	X	X															
1008.1.9.6		X																		
1008.1.9.7		X																		
1008.1.9.7 (Item 5.1 only)		X				X														
1008.1.9.8		X																		
1008.1.9.10		X																		
1008.1.9.12		X																		
1008.1.10		X																		
1008.1.11		X																		
1009 (1st paragraph below title only)						X														
1009.3		X																		
1009.4		X																		
1009.7.2 [DSA-AC: exc. 6 only]		X	X	X	X	X														

(continued)



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 10 – MEANS OF EGRESS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X												
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X				X	X		X								
Adopt only those sections that are listed below						X														
Chapter / Section																				
1009.8		X																		
1009.15 (2nd paragraph only)		X				X														
1010 (1st paragraph below title only)						X														
1010.1			X	X	X															
1010.7.3			X	X	X															
1010.7.4			X	X	X															
1010.7.5			X	X	X															
1010.10			X	X	X															
1011.1		X																		
1011.2		X																		
1011.4		X	X	X	X	X														
1011.7		X																		
1011.8		X																		
1012 (1st paragraph below title only)						X														
1012.8		X																		
1013.2						X														
1013.3		X	X	X	X	X														
1013.4		X																		
1014.2		X																		
1014.2.2		X																		
1014.3		X																		
1015.1		X																		
Table 1015.1		X																		
1015.2		X																		
1015.2.2		X																		
1015.5		X																		
1015.6		X																		
1015.7		X																		
Table 1016.1		X																		
Table 1016.2		X																		
1016.2.2		X																		
1017 (1st paragraph below title only)						X														
1017.2 Exc. only						X														
1017.3 Exc. only						X														
1018.1		X																		
Table 1018.1		X																		
Table 1018.2		X																		
1018.4		X																		

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 10 – MEANS OF EGRESS—continued**

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X						X	X												
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X	X	X	X				X	X		X								
<i>Adopt only those sections that are listed below</i>						X														
<i>Chapter / Section</i>																				
1018.5		X							X	X		X								
1018.5, Exception 5									X	X		X								
1018.5.1		X																		
1018.6		X																		
1021.1		X																		
Table 1021.1		X																		
1021.2		X																		
Table 1021.2(1)		X																		
Table 1021.2(2)		X																		
1021.2		X																		
1021.2.1		X																		
1021.2.2		X																		
1021.3		X																		
1022.2		X																		
1022.9		X	X	X	X															
1022.9 (2nd paragraph only)						X														
1022.9.1		X																		
1022.10		X																		
1022.10.1		X																		
1022.10.2		X																		
1023.2		X																		
1025.4		X																		
1026.2		X																		
1027.1		X																		
1027.5		X																		
1028.1		X																		
1028.2		X																		
1028.3		X																		
1028.3.1		X																		
1028.6.1		X																		
1028.6.4		X																		
1028.9.1		X																		
1028.10		X																		
1029.1		X																		
1029.4		X																		

## CHAPTER 10

# MEANS OF EGRESS

### SECTION 1001 ADMINISTRATION

**1001.1 General.** Buildings or portions thereof shall be provided with a means of egress system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof.

**1001.2 Minimum requirements.** It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the capacity of the means of egress to less than required by this code.

**[F] 1001.3 Maintenance.** Means of egress shall be maintained in accordance with the *California Fire Code*.

**[F] 1001.4 Fire safety and evacuation plans.** Fire safety and evacuation plans shall be provided for all occupancies and buildings where required by the *California Fire Code*. Such fire safety and evacuation plans shall comply with the applicable provisions of Sections 401.2 and 404 of the *California Fire Code*.

### SECTION 1002 DEFINITIONS

**1002.1 Definitions.** The following terms are defined in Chapter 2:

**ACCESSIBLE MEANS OF EGRESS.**

**AISLE.**

**AISLE ACCESSWAY.**

**ALTERNATING TREAD DEVICE.**

**AREA OF REFUGE.**

**BLEACHERS.**

**COMMON PATH OF EGRESS TRAVEL.**

**CORRIDOR.**

**DOOR, BALANCED.**

**EGRESS COURT.**

**EMERGENCY ESCAPE AND RESCUE OPENING.**

**EXIT.**

**EXIT ACCESS.**

**EXIT ACCESS DOORWAY.**

**EXIT ACCESS RAMP.**

**EXIT ACCESS STAIRWAY.**

**EXIT DISCHARGE.**

**EXIT DISCHARGE, LEVEL OF.**

**EXIT, HORIZONTAL.**

**EXIT PASSAGEWAY.**

**FIRE EXIT HARDWARE.**

**FIXED SEATING.**

**FLIGHT.**

**FLOOR AREA, GROSS.**

**FLOOR AREA, NET.**

**FOLDING AND TELESCOPIC SEATING.**

**GRANDSTAND.**

**GUARD ([DSA-AC, HCD 1 & HCD 2] or GUARDRAIL).**

**HANDRAIL.**

**INTERIOR EXIT RAMP.**

**INTERIOR EXIT STAIRWAY.**

**MEANS OF EGRESS.**

**MERCHANDISE PAD.**

**NOSING.**

**OCCUPANT LOAD.**

**PANIC HARDWARE.**

**PHOTOLUMINESCENT.**

**PUBLIC WAY.**

**RAMP.**

**SCISSOR STAIR.**

**SELF-LUMINOUS.**

**SMOKE-PROTECTED ASSEMBLY SEATING.**

**STAIR.**

**STAIRWAY.**

**STAIRWAY, EXTERIOR.**

**STAIRWAY, INTERIOR.**

**STAIRWAY, SPIRAL.**

**WINDER.**

### SECTION 1003 GENERAL MEANS OF EGRESS

**1003.1 Applicability.** The general requirements specified in Sections 1003 through 1013 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.

*(DSA-AC & HCD 1-AC) In addition to the requirement of this chapter, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development, or Section 1.9.1 regulated by the Division of*

the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, as applicable.

**Exception:** Exiting requirements for Fixed Guideway Transit Systems shall be as per Section 433.3.

**1003.1.1 Means of egress for hospitals, skilled nursing facilities and intermediate care facilities and correctional treatment centers.** [OSHPD 1 & 4] See Section 3417A.

**1003.1.1 Means of egress for single-story light frame skilled nursing facilities and intermediate care facilities.** [OSHPD 2] See Section 3424.

**1003.2 Ceiling height.** The means of egress shall have a ceiling height of not less than 7 feet 6 inches (2286 mm).

**Exceptions:**

1. Sloped ceilings in accordance with Section 1208.2.
2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with Section 1208.2.
3. Allowable projections in accordance with Section 1003.3.
4. Stair headroom in accordance with Section 1009.5.
5. Door height in accordance with Section 1008.1.1.
6. Ramp headroom in accordance with Section 1010.6.2.
7. The clear height of floor levels in vehicular and pedestrian traffic areas in parking garages in accordance with Section 406.4.1. **(DSA-AC & HCD 1-AC)** The clear height of vehicle and pedestrian areas required to be accessible, or identified as accessible, shall comply with Chapter 11A or Chapter 11B, as applicable.
8. Areas above and below mezzanine floors in accordance with Section 505.2.
9. In Group I-2, I-2.1 and I-3 occupancies, the means of egress shall have a ceiling height of not less than 8 feet (2439 mm).

**1003.3 Protruding objects.** Protruding objects shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.

**Exception:** In Group I-2 and Group I-2.1 occupancies, protruding objects shall not extend more than 12 inches (305 mm) below the minimum ceiling height required by Section 1003.2.

**1003.3.1 Headroom.** Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 provided a minimum headroom of 80 inches (2032 mm) shall be provided for any walking surface, including walks, corridors, aisles and passageways. Not more than 50 percent of the ceiling area of a means of egress shall be reduced in height by protruding objects.

**Exception:** Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm).

A barrier shall be provided where the vertical clearance is less than 80 inches (2032 mm) high. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the floor.

**1003.3.2 Post-mounted objects.** A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 4 inches (102 mm) where the lowest point of the leading edge is more than 27 inches (686 mm) and less than 80 inches (2032 mm) above the walking surface. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (686 mm) maximum or 80 inches (2032 mm) minimum above the finished floor or ground.

**Exception:** These requirements shall not apply to sloping portions of handrails between the top and bottom riser of stairs and above the ramp run.

**1003.3.3 Horizontal projections.** Structural elements, fixtures or furnishings shall not project horizontally from either side more than 4 inches (102 mm) over any walking surface between the heights of 27 inches (686 mm) and 80 inches (2032 mm) above the walking surface.

**Exception:** Handrails are permitted to protrude 4½ inches (114 mm) from the wall.

**1003.3.3.1 Horizontal projections for Group I-2 occupancies.** Structural elements, fixtures or furnishings shall not project horizontally from either side more than 1½ inches (38 mm) into the required width of an exit access corridor serving any area caring for one or more nonambulatory or bedridden persons.

**Exceptions:**

1. Handrails are permitted to protrude 3½ inches (89 mm) from the wall.
2. Alcohol-based hand-rub dispensers are permitted to protrude 4 inches.
3. Manual fire alarm boxes with a protective cover installed are permitted to protrude 4 inches.

**1003.3.4 Clear width.** Protruding objects shall not reduce the minimum clear width of accessible routes as required in Chapter 11A or Chapter 11B.

**1003.4 Floor surface.** Walking surfaces of the means of egress shall have a slip-resistant surface and be securely attached.

**1003.5 Elevation change.** Where changes in elevation of less than 12 inches (305 mm) exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal (5-percent slope), ramps complying with Section 1010 shall be used. Where the difference in elevation is 6 inches (152 mm) or less, the ramp shall be equipped with either handrails or floor finish materials that contrast with adjacent floor finish materials.

**Exceptions:**

1. A single step with a maximum riser height of 7 inches (178 mm) is permitted for buildings with occupancies in Groups F, H, R-2, R-3, S and U at exterior doors not required to be accessible by Chapter 11A or 11B.

2. A stair with a single riser or with two risers and a tread is permitted at locations not required to be accessible by Chapter 11A or 11B, provided that the risers and treads comply with Section 1009.7, the minimum depth of the tread is 13 inches (330 mm) and at least one handrail complying with Section 1012 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the stair.
3. A step is permitted in aisles serving seating that has a difference in elevation less than 12 inches (305 mm) at locations not required to be accessible by Chapter 11A or 11B, provided that the risers and treads comply with Section 1028.11 and the aisle is provided with a handrail complying with Section 1028.13.

Throughout a story in a Group I-2 occupancy, any change in elevation in portions of the means of egress that serve non-ambulatory persons shall be by means of a ramp or sloped walkway.

**1003.6 Means of egress continuity.** The path of egress travel along a means of egress shall not be interrupted by any building element other than a means of egress component as specified in this chapter. Obstructions shall not be placed in the required width of a means of egress except projections permitted by this chapter. The required capacity of a means of egress system shall not be diminished along the path of egress travel.

**1003.7 Elevators, escalators and moving walks.** Elevators, escalators and moving walks shall not be used as a component of a required means of egress from any other part of the building.

**Exception:** Elevators used as an accessible means of egress in accordance with Section 1007.4.

## SECTION 1004 OCCUPANT LOAD

**1004.1 Design occupant load.** In determining means of egress requirements, the number of occupants for whom means of egress facilities shall be provided shall be determined in accordance with this section.

**1004.1.1 Cumulative occupant loads.** Where the path of egress travel includes intervening rooms, areas or spaces, cumulative occupant loads shall be determined in accordance with this section.

**1004.1.1.1 Intervening spaces or accessory areas.** Where occupants egress from one or more rooms, areas or spaces through others, the design occupant load shall be the combined occupant load of interconnected accessory or intervening spaces. Design of egress path capacity shall be based on the cumulative portion of occupant loads of all rooms, areas or spaces to that point along the path of egress travel.

**1004.1.1.2 Adjacent levels for mezzanines.** That portion of occupant load of a mezzanine with all required egress through a room, area or space on an adjacent

level shall be added to the occupant load of that room, area or space.

**1004.1.1.3 Adjacent stories.** Other than for the egress components designed for convergence in accordance with Section 1005.6, the occupant load from separate stories shall not be added.

**1004.1.2 Areas without fixed seating.** The number of occupants shall be computed at the rate of one occupant per unit of area as prescribed in Table 1004.1.2. For areas without fixed seating, the occupant load shall not be less than that number determined by dividing the floor area under consideration by the occupant load factor assigned to the function of the space as set forth in Table 1004.1.2. Where an intended function is not listed in Table 1004.1.2, the building official shall establish a function based on a listed function that most nearly resembles the intended function.

**Exception:** Where approved by the building official, the actual number of occupants for whom each occupied space, floor or building is designed, although less than those determined by calculation, shall be permitted to be used in the determination of the design occupant load.

**1004.2 Increased occupant load.** The occupant load permitted in any building, or portion thereof, is permitted to be increased from that number established for the occupancies in Table 1004.1.2, provided that all other requirements of the code are also met based on such modified number and the occupant load does not exceed one occupant per 7 square feet (0.65 m<sup>2</sup>) of occupiable floor space. Where required by the building official, an approved aisle, seating or fixed equipment diagram substantiating any increase in occupant load shall be submitted. Where required by the building official, such diagram shall be posted.

**1004.3 Posting of occupant load.** Every room or space that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.

**1004.4 Fixed seating.** For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein. The occupant load for areas in which fixed seating is not installed, such as waiting spaces, shall be determined in accordance with Section 1004.1.2 and added to the number of fixed seats.

The occupant load of wheelchair spaces and the associated companion seat shall be based on one occupant for each wheelchair space and one occupant for the associated companion seat provided in accordance with Section 1108.2.3.

For areas having fixed seating without dividing arms, the occupant load shall not be less than the number of seats based on one person for each 18 inches (457 mm) of seating length.

The occupant load of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.

## MEANS OF EGRESS

**1004.5 Outdoor areas.** Yards, patios, courts and similar outdoor areas accessible to and usable by the building occupants shall be provided with means of egress as required by this chapter. The occupant load of such outdoor areas shall be assigned by the building official in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, means of egress requirements for the building shall be based on the sum of the occupant loads of the building plus the outdoor areas.

### Exceptions:

1. Outdoor areas used exclusively for service of the building need only have one means of egress.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2.

**1004.6 Multiple occupancies.** Where a building contains two or more occupancies, the means of egress requirements shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same means of egress system, those egress components shall meet the more stringent requirements of all occupancies that are served.

## SECTION 1005 MEANS OF EGRESS SIZING

**1005.1 General.** All portions of the means of egress system shall be sized in accordance with this section.

**Exception:** Means of egress complying with Section 1028.

**1005.2 Minimum width based on component.** The minimum width, in inches (mm), of any means of egress components shall not be less than that specified for such component, elsewhere in this code.

**1005.3 Required capacity based on occupant load.** The required capacity, in inches (mm), of the means of egress for any room, area, space or story shall not be less than that determined in accordance with Sections 1005.3.1 and 1005.3.2:

**1005.3.1 Stairways.** The capacity, in inches (mm), of means of egress stairways shall be calculated by multiplying the occupant load served by such stairway by a means of egress capacity factor of 0.3 inch (7.6 mm) per occupant. Where stairways serve more than one story, only the occupant load of each story considered individually shall be used in calculating the required capacity of the stairways serving that story.

### Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches (mm), of means of egress stairways shall be calculated by multiplying the occupant load served by such stairway by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency

**TABLE 1004.1.2  
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT**

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR <sup>a</sup>
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly	
Gaming floors (keno, slots, etc.)	11 gross
Exhibit Gallery and Museum	30 net
Assembly with fixed seats	See Section 1004.4
Assembly without fixed seats	
Concentrated (chairs only-not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	100 gross
Courtrooms—other than fixed seating areas	40 net
Day care	35 net
Dormitories	50 gross
Educational	
Classroom area	20 net
Shops and other vocational room areas	50 net
Exercise rooms	50 gross
Group H-5 Fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Kitchens, commercial	200 gross
Laboratory	
Educational	50 net
Laboratories, non-educational	100 net
Laboratory suite <sup>b</sup>	200 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Mall buildings—covered and open	See Section 402.8.2
Mercantile	
Areas on other floors	60 gross
Basement and grade floor areas	30 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools	
Rink and pool	50 gross
Decks	15 gross
Stages and platforms	15 net
Warehouses	500 gross

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

a. Floor area in square feet per occupant.

b. See Section 443.2.

voice/alarm communication system in accordance with Section 907.5.2.2.

2. *For Group H-1, H-2, H-3 and H-4 occupancies the total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.7 inches (7.62 mm) per occupant.*
3. *Means of egress complying with Section 1028.*

**1005.3.2 Other egress components.** The capacity, in inches (mm), of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant.

**Exceptions:**

1. For other than Group H and I-2 occupancies, the capacity, in inches (mm), of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.15 inch (3.8 mm) per occupant in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.
2. *For Group H-1, H-2, H-3 and H-4 occupancies the total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.4 inches (5.08 mm) per occupant.*
3. *Means of egress complying with Section 1028.*

**1005.4 Continuity.** The capacity of the means of egress required from any story of a building shall not be reduced along the path of egress travel until arrival at the public way.

**1005.5 Distribution of egress capacity.** Where more than one exit, or access to more than one exit, is required, the means of egress shall be configured such that the loss of any one exit, or access to one exit, shall not reduce the available capacity to less than 50 percent of the required capacity.

**1005.6 Egress convergence.** Where the means of egress from stories above and below converge at an intermediate level, the capacity of the means of egress from the point of convergence shall not be less than the sum of the required capacities for the two adjacent stories.

**1005.7 Encroachment.** Encroachments into the required means of egress width shall be in accordance with the provisions of this section.

**1005.7.1 Doors.** Doors, when fully opened, shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half.

**Exceptions:**

1. *In other than Group I-2 occupancies, surface-mounted latch release hardware shall be exempt*

from inclusion in the 7-inch maximum (178 mm) encroachment where:

- 1.1. The hardware is mounted to the side of the door facing away from the adjacent wall where the door is in the open position; and
  - 1.2. The hardware is mounted not less than 34 inches (865 mm) nor more than 48 inches (1219 mm) above the finished floor.
2. The restrictions on door swing shall not apply to doors within individual dwelling units and sleeping units of Group R-2 occupancies and dwelling units of Group R-3 occupancies.

**1005.7.2 Other projections.** Handrail projections shall be in accordance with the provisions of Section 1012.8. Other nonstructural projections such as trim and similar decorative features shall be permitted to project into the required width a maximum of 1½ inches (38 mm) on each side.

**1005.7.3 Protruding objects.** Protruding objects shall comply with the applicable requirements of Section 1003.3.

## SECTION 1006 MEANS OF EGRESS ILLUMINATION

**1006.1 Illumination required.** The means of egress, including the exit discharge, shall be illuminated at all times the building space served by the means of egress is occupied.

**Exceptions:**

1. Occupancies in Group U.
2. Aisle accessways in Group A.
3. Dwelling units and sleeping units in Groups R-1, R-2 and R-3.
4. Sleeping units of Group I, *R-2.1 and R-4 occupancies.*

**1006.2 Illumination level.** The means of egress illumination level shall not be less than 1 footcandle (11 lux) at the walking surface.

**Exception:** For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the walking surface is permitted to be reduced during performances to not less than 0.2 footcandle (2.15 lux), provided that the required illumination is automatically restored upon activation of a premises' fire alarm system where such system is provided.

**1006.3 Emergency power for illumination.** The power supply for means of egress illumination shall normally be provided by the premises' electrical supply.

In the event of power supply failure, an emergency electrical system shall automatically illuminate all of the following areas:

1. Aisles and unenclosed egress stairways in rooms and spaces that require two or more means of egress.

2. Corridors, interior exit stairways and ramps and exit passageways in buildings required to have two or more exits.
3. Exterior egress components at other than their levels of exit discharge until exit discharge is accomplished for buildings required to have two or more exits.
4. Interior exit discharge elements, as permitted in Section 1027.1, in buildings required to have two or more exits.
5. Exterior landings as required by Section 1008.1.6 for exit discharge doorways in buildings required to have two or more exits.

The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702.

**1006.3.1 Illumination level under emergency power.**

Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 1 footcandle (11 lux) and a minimum at any point of 0.1 footcandle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle (6 lux) average and a minimum at any point of 0.06 footcandle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

**SECTION 1007  
ACCESSIBLE MEANS OF EGRESS**

**1007.1 Accessible means of egress required.** Accessible means of egress shall comply with this section. Accessible spaces shall be provided with not less than one accessible means of egress. Where more than one means of egress are required by Section 1015.1 or 1021.1 from any accessible space, each accessible portion of the space shall be served by accessible means of egress *in at least the same number as required by Section 1015.1 or 1021.1. In addition to the requirements of this chapter, means of egress, which provide access to, or egress from, buildings for persons with disabilities, shall also comply with the requirements of Chapter 11A or 11B as applicable.*

**Exceptions:**

1. Accessible means of egress are not required in alterations to existing buildings.
2. One accessible means of egress is required from an accessible mezzanine level in accordance with Section 1007.3, 1007.4 or 1007.5, *and Chapter 11A or 11B, as applicable.*
3. In assembly areas with sloped or stepped aisles, one accessible means of egress is permitted where the common path of travel is accessible and meets the requirements in Section 1028.8, *and Chapter 11A or 11B, as applicable.*

**1007.2 Continuity and components.** Each required accessible means of egress shall be continuous to a public way and shall consist of one or more of the following components:

1. Accessible routes complying with *Chapter 11A, Sections 1110A.1 and 1120A, or Chapter 11B, Sections 11B-206 and 11B-402, as applicable.*
2. Interior exit stairways complying with *Sections 1007.3 and 1022, and Chapter 11A, Section 1123A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*
3. Interior exit access stairways complying with *Sections 1007.3 and 1009.3, Chapter 11A, Section 1123A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*
4. Exterior exit stairways complying with *Sections 1007.3 and 1026, and Chapter 11A, Section 1115A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*
5. Elevators complying with *Section 1007.4, and Chapter 11A, Section 1124A, or Chapter 11B, Sections 11B-206.6 and 11B-407, as applicable.*
6. Platform lifts complying with *Section 1007.5 and Chapter 11A, Section 1124A, or Chapter 11B, Sections 11B-206.7, 11B-207.2 and 11B-410 as applicable.*
7. Horizontal exits complying with *Section 1025.*
8. Ramps complying with *Section 1010, and Chapter 11A, Sections 1114A and 1122A, or Chapter 11B, 11B-405, as applicable.*
9. Areas of refuge complying with *Section 1007.6.*
10. Exterior area for assisted rescue complying with *Section 1007.7.*

**1007.2.1 Elevators required.** In buildings where a required accessible floor is four or more stories above or below a level of exit discharge, at least one required accessible means of egress shall be an elevator complying with Section 1007.4.

**Exceptions:**

1. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a horizontal exit and located at or above the levels of exit discharge.
2. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a ramp conforming to the provisions of Section 1010.

**1007.3 Stairways.** In order to be considered part of an accessible means of egress, a stairway between stories shall have a clear width of 48 inches (1219 mm) minimum between hand-



rails and shall either incorporate an area of refuge within an enlarged floor-level landing or shall be accessed from either an area of refuge complying with Section 1007.6 or a horizontal exit. Exit access stairways that connect levels in the same story are not permitted as part an accessible means of egress. **[DSA-AC & HCD 1-AC]** In addition, exit stairways shall comply with Chapter 11A, Sections 1115A and 1123A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.

#### Exceptions:

1. The clear width of 48 inches (1219 mm) between handrails is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Areas of refuge are not required at stairways in buildings equipped throughout by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. The clear width of 48 inches (1219 mm) between handrails is not required for stairways accessed from a horizontal exit.
4. Areas of refuge are not required at stairways serving open parking garages.
5. Areas of refuge are not required for smoke protected seating areas complying with Section 1028.6.2.
6. The areas of refuge are not required in Group R-2 occupancies.

**1007.4 Elevators.** In order to be considered part of an accessible means of egress, an elevator shall comply with the emergency operation and signaling device requirements of *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*. Standby power shall be provided in accordance with Chapter 27 and Section 3003. The elevator shall be accessed from either an area of refuge complying with Section 1007.6 or a horizontal exit.

#### Exceptions:

1. Elevators are not required to be accessed from an area of refuge or horizontal exit in open parking garages.
2. Elevators are not required to be accessed from an area of refuge or horizontal exit in buildings and facilities equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Elevators not required to be located in a shaft in accordance with Section 712 are not required to be accessed from an area of refuge or horizontal exit.
4. Elevators are not required to be accessed from an area of refuge or horizontal exit for smoke protected seating areas complying with Section 1028.6.2.

**1007.5 Platform lifts.** Platform (wheelchair) lifts shall not serve as part of an accessible means of egress, except where allowed as part of a required accessible route in Chapter 11A, Sections 1121A and 1124A.11, or Chapter 11B, Sections

11B-206.7.1 through 11B-206.7.10, as applicable. Standby power shall be provided in accordance with Chapter 27 for platform lifts permitted to serve as part of a means of egress.

**[DSA-AC]** See Chapter 11B, Section 11B-207.2 for additional accessible means of egress requirements at platform lifts.

**1007.5.1 Openness.** Platform lifts on an accessible means of egress shall not be installed in a fully enclosed hoistway.

**1007.6 Areas of refuge.** Every required area of refuge shall be accessible from the space it serves by an accessible means of egress. The maximum travel distance from any accessible space to an area of refuge shall not exceed the travel distance permitted for the occupancy in accordance with Section 1016.1. Every required area of refuge shall have direct access to a stairway complying with Sections 1007.3 or an elevator complying with Section 1007.4. Where an elevator lobby is used as an area of refuge, the shaft and lobby shall comply with Section 1022.10 for smokeproof enclosures except where the elevators are in an area of refuge formed by a horizontal exit or smoke barrier. **[DSA-AC]** Areas of refuge shall comply with the requirements of this code and shall adjoin an accessible route complying with Sections 11B-206 and 11B-402.

**1007.6.1 Size.** Each area of refuge shall be sized to accommodate two wheelchair spaces that are not less than 30 inches by 48 inches (762 mm by 1219 mm). The total number of such 30-inch by 48-inch (762 mm by 1219 mm) spaces per story shall be not less than one for every 200 persons of calculated occupant load served by the area of refuge. Such wheelchair spaces shall not reduce the required means of egress width. Access to any of the required wheelchair spaces in an area of refuge shall not be obstructed by more than one adjoining wheelchair space.

**Exception:** The enforcing agency may reduce the size of each required area of refuge to accommodate one wheelchair space that is not less than 30 inches by 48 inches (762 mm by 1219 mm) on floors where the occupant load is less than 200.

**1007.6.2 Separation.** Each area of refuge shall be separated from the remainder of the story by a smoke barrier complying with Section 709 or a horizontal exit complying with Section 1025. Each area of refuge shall be designed to minimize the intrusion of smoke.

**Exception:** Areas of refuge located within an enclosure for exit access stairways or interior exit stairways.

**1007.6.3 Two-way communication.** Areas of refuge shall be provided with a two-way communication system complying with Sections 1007.8.1 and 1007.8.2.

**1007.7 Exterior area for assisted rescue.** Exterior areas for assisted rescue shall be accessed by an accessible route from the area served. Exterior areas for assisted rescue shall be permitted in accordance with Section 1007.7.1 or 1007.7.2.

**1007.7.1 Level of exit discharge.** Where the exit discharge does not include an accessible route from an exit located on a level of exit discharge to a public way, an exterior area of assisted rescue shall be provided on the

exterior landing in accordance with Sections 1007.7.3 through 1007.7.6.

**1007.7.2 Outdoor facilities.** Where exit access from the area serving outdoor facilities is essentially open to the outside, an exterior area of assisted rescue is permitted as an alternative to an area of refuge. Every required exterior area of assisted rescue shall have direct access to an interior exit stairway, exterior stairway, or elevator serving as an accessible means of egress component. The exterior area of assisted rescue shall comply with Sections 1007.7.3 through 1007.7.6 and shall be provided with a two-way communication system complying with Sections 1007.8.1 and 1007.8.2.

**1007.7.3 Size.** Each exterior area for assisted rescue shall be sized to accommodate wheelchair spaces in accordance with Section 1007.6.1.

**1007.7.4 Separation.** Exterior walls separating the exterior area of assisted rescue from the interior of the building shall have a minimum fire-resistance rating of 1 hour, rated for exposure to fire from the inside. The fire-resistance-rated exterior wall construction shall extend horizontally 10 feet (3048 mm) beyond the landing on either side of the landing or equivalent fire-resistance-rated construction is permitted to extend out perpendicular to the exterior wall 4 feet (1219 mm) minimum on the side of the landing. The fire-resistance-rated construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the floor level of the area for assisted rescue or to the roof line, whichever is lower. Openings within such fire-resistance-rated exterior walls shall be protected in accordance with Section 716.

**1007.7.5 Openness.** The exterior area for assisted rescue shall be open to the outside air. The sides other than the separation walls shall be at least 50 percent open, and the open area shall be distributed so as to minimize the accumulation of smoke or toxic gases.

**1007.7.6 Stairway.** Stairways that are part of the means of egress for the exterior area for assisted rescue shall provide a clear width of 48 inches (1219 mm) between handrails.

**Exception:** The clear width of 48 inches (1219 mm) between handrails is not required at stairways serving buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

**1007.8 Two-way communication.** A two-way communication system shall be provided at the elevator landing on each accessible floor that is one or more stories above or below the story of exit discharge complying with Sections 1007.8.1 and 1007.8.2.

**Exceptions:**

1. Two-way communication systems are not required at the elevator landing where the two-way communication system is provided within areas of refuge in accordance with Section 1007.6.3.

2. Two-way communication systems are not required on floors provided with ramps conforming to the provisions of Section 1010.

**1007.8.1 System requirements.** Two-way communication systems shall provide communication between each required location and a central control point location approved by the fire department. Where the central control point is not constantly attended, a two-way communication system shall have a timed automatic telephone dial-out capability to an approved monitoring location. The two-way communication system shall include both audible and visible signals.

**1007.8.1.1 Visible communication method. [DSA-AC and HCD 1-AC]** A button complying with Section 1138A.4 or Sections 11B-205 and 11B-309 in the area of refuge shall activate both a light in the area of refuge indicating that rescue has been requested and a light at the central control point indicating that rescue is being requested. A button at the central control point shall activate both a light at the central control point and a light in the area of refuge indicating that the request has been received.

**1007.8.2 Directions.** Directions for the use of the two-way communication system, instructions for summoning assistance via the two-way communication system and written identification of the specific story, floor location and building address or other building identifier shall be posted adjacent to the two-way communication system.

**1007.9 Signage.** Signage indicating special accessibility provisions shall be provided as shown:

1. Each door providing access to an area of refuge from an adjacent floor area shall be identified by a sign stating: AREA OF REFUGE.
2. Each door providing access to an exterior area for assisted rescue shall be identified by a sign stating: EXTERIOR AREA FOR ASSISTED RESCUE.

Signage shall comply with Chapter 11A, Section 1143A and Chapter 11B, Section 11B-703.5 as applicable, requirements for visual characters and include the International Symbol of Accessibility complying with Chapter 11B, Section 11B-703.7.2.1. Where exit sign illumination is required by Section 1011.2, the signs shall be illuminated. Additionally, raised character and Braille signage complying with Chapter 11A, Section 1143A and Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5, and the International Symbol of Accessibility complying with Chapter 11B, Section 11B-703.7.2.1, shall be located at each door to an area of refuge and exterior area for assisted rescue in accordance with Section 1011.4.

**1007.10 Directional signage.** Direction signage complying with Chapter 11B, Section 11B-703.5 indicating the location of the other means of egress and which are accessible means of egress shall be provided at the following:

1. At exits serving a required accessible space but not providing an approved accessible means of egress.

2. At elevator landings.
3. Within areas of refuge.

**1007.11 Instructions.** In areas of refuge and exterior areas for assisted rescue, instructions on the use of the area under emergency conditions shall be posted. The instructions shall include all of the following *and shall comply with Chapter 11B, Section 11B-703.5*:

1. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.
2. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.
3. Directions for use of the two-way communications system where provided.

**1007.12 Alarms/emergency warning systems/accessibility.** *If emergency warning systems are required, they shall activate a means of warning the hearing impaired. Emergency warning systems as part of the fire-alarm system shall be designed and installed in accordance with NFPA 72 as amended in Chapter 35.*

## SECTION 1008 DOORS, GATES AND TURNSTILES

**[DSA-AC]** *In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Sections 11B-206.5 and 11B-404, as applicable.*

**1008.1 Doors.** Means of egress doors shall meet the requirements of this section. Doors serving a means of egress system shall meet the requirements of this section and Section 1020.2. Doors provided for egress purposes in numbers greater than required by this code shall meet the requirements of this section.

Means of egress doors shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.

**1008.1.1 Size of doors.** The minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of 32 inches (813 mm). Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where this section requires a minimum clear width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches (813 mm). The maximum width of a swinging door leaf shall be 48 inches (1219 mm) nominal. Means of egress doors in a Group I-2 occupancy used for the movement of beds and litter patients shall provide a clear width

not less than 44 inches (1054 mm). The height of door openings shall not be less than 80 inches (2032 mm).

### Exceptions:

1. The minimum and maximum width shall not apply to door openings that are not part of the required means of egress in Group R-2 and R-3 occupancies.
2. Door openings to resident sleeping units in Group I-3 occupancies shall have a clear width of not less than 28 inches (711 mm).
3. Door openings to storage closets less than 10 square feet (0.93 m<sup>2</sup>) in area shall not be limited by the minimum width.
4. Width of door leaves in revolving doors that comply with Section 1008.1.4.1 shall not be limited.
5. Door openings within a dwelling unit or sleeping unit shall not be less than 78 inches (1981 mm) in height.
6. Exterior door openings in dwelling units and sleeping units, other than the required exit door, shall not be less than 76 inches (1930 mm) in height.
7. In other than Group R-1 occupancies, the minimum widths shall not apply to interior egress doors within a dwelling unit or sleeping unit that is not required to be *adaptable or accessible as specified in Chapter 11A*.

**1008.1.1.1 Projections into clear width.** There shall not be projections into the required clear width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).

### Exceptions:

1. Door closers and door stops shall be permitted to be 78 inches (1980 mm) minimum above the floor.
2. *In a Group I-2 occupancy, there shall be no projections into the clear width of doors used for the movement of beds and litter patients in the means of egress.*

**1008.1.2 Door swing.** Egress doors shall be of the pivoted or side-hinged swinging type.

### Exceptions:

1. Private garages, office areas, factory and storage areas with an occupant load of 10 or less.
2. Group I-3 occupancies used as a place of detention.
3. Critical or intensive care patient rooms within suites of health care facilities.
4. Doors within or serving a single dwelling unit in Groups R-2 and R-3.

5. In other than Group H occupancies, revolving doors complying with Section 1008.1.4.1.
6. In other than Group H occupancies, horizontal sliding doors complying with Section 1008.1.4.3 are permitted in a means of egress.
7. Power-operated doors in accordance with Section 1008.1.4.2.
8. Doors serving a bathroom within an individual sleeping unit in Group R-1.
9. In other than Group H occupancies, manually operated horizontal sliding doors are permitted in a means of egress from spaces with an occupant load of 10 or less.
10. *In I-2 and I-2.1 occupancies, exit doors serving an occupant load of 10 or more, may be of the pivoted or balanced type.*

Doors shall swing in the direction of egress travel where serving a room or area containing an occupant load of 50 or more persons or a Group H occupancy. *For Group L occupancies, see Section 443.6.3.*

*In a Group I-2 occupancy, all required exterior egress doors shall open in the direction of egress regardless of the occupant load served.*

**1008.1.3 Door opening force.** The force for pushing or pulling open interior swinging egress doors, other than fire doors, shall not exceed 5 pounds (22 N). For other swinging doors, as well as sliding and folding doors, the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force.

**1008.1.3.1 Location of applied forces.** Forces shall be applied to the latch side of the door.

**1008.1.4 Special doors.** Special doors and security grilles shall comply with the requirements of Sections 1008.1.4.1 through 1008.1.4.4.

**1008.1.4.1 Revolving doors.** Revolving doors shall comply with the following:

1. Each revolving door shall be capable of collapsing into a bookfold position with parallel egress paths providing an aggregate width of 36 inches (914 mm).
2. A revolving door shall not be located within 10 feet (3048 mm) of the foot of or top of stairs or escalators. A dispersal area shall be provided between the stairs or escalators and the revolving doors.
3. The revolutions per minute (rpm) for a revolving door shall not exceed those shown in Table 1008.1.4.1.
4. Each revolving door shall have a side-hinged swinging door which complies with Section

1008.1 in the same wall and within 10 feet (3048 mm) of the revolving door.

5. Revolving doors shall not be part of an accessible route required by Section 1007 and *Chapter 11A or 11B.*

**TABLE 1008.1.4.1  
REVOLVING DOOR SPEEDS**

INSIDE DIAMETER (feet-inches)	POWER-DRIVEN-TYPE SPEED CONTROL (rpm)	MANUAL-TYPE SPEED CONTROL (rpm)
6-6	11	12
7-0	10	11
7-6	9	11
8-0	9	10
8-6	8	9
9-0	8	9
9-6	7	8
10-0	7	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**1008.1.4.1.1 Egress component.** A revolving door used as a component of a means of egress shall comply with Section 1008.1.4.1 and the following three conditions:

1. Revolving doors shall not be given credit for more than 50 percent of the required egress capacity.
2. Each revolving door shall be credited with no more than a 50-person capacity.
3. Each revolving door shall be capable of being collapsed when a force of not more than 130 pounds (578 N) is applied within 3 inches (76 mm) of the outer edge of a wing.

**1008.1.4.1.2 Other than egress component.** A revolving door used as other than a component of a means of egress shall comply with Section 1008.1.4.1. The collapsing force of a revolving door not used as a component of a means of egress shall not be more than 180 pounds (801 N).

**Exception:** A collapsing force in excess of 180 pounds (801 N) is permitted if the collapsing force is reduced to not more than 130 pounds (578 N) when at least one of the following conditions is satisfied:

1. There is a power failure or power is removed to the device holding the door wings in position.
2. There is an actuation of the automatic sprinkler system where such system is provided.
3. There is an actuation of a smoke detection system which is installed in accordance with Section 907 to provide coverage in

areas within the building which are within 75 feet (22 860 mm) of the revolving doors.

4. There is an actuation of a manual control switch, in an approved location and clearly defined, which reduces the holding force to below the 130-pound (578 N) force level.

**1008.1.4.2 Power-operated doors.** Where means of egress doors are operated by power, such as doors with a photoelectric-actuated mechanism to open the door upon the approach of a person, or doors with power-assisted manual operation, the design shall be such that in the event of power failure, the door is capable of being opened manually to permit means of egress travel or closed where necessary to safeguard means of egress. The forces required to open these doors manually shall not exceed those specified in Section 1008.1.3, except that the force to set the door in motion shall not exceed 50 pounds (220 N). The door shall be capable of swinging from any position to the full width of the opening in which such door is installed when a force is applied to the door on the side from which egress is made. Full-power-operated doors shall comply with BHMA A156.10. Power-assisted and low-energy doors shall comply with BHMA A156.19.

**Exceptions:**

1. Occupancies in Group I-3.
2. Horizontal sliding doors complying with Section 1008.1.4.3.
3. For a biparting door in the emergency break-out mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32-inch (813 mm) single-leaf requirement of Section 1008.1.1, provided a minimum 32-inch (813 mm) clear opening is provided when the two biparting leaves meeting in the center are broken out.

**1008.1.4.3 Horizontal sliding doors.** In other than Group H occupancies, horizontal sliding doors permitted to be a component of a means of egress in accordance with Exception 6 to Section 1008.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The doors shall be openable by a simple method from both sides without special knowledge or effort.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.

5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic closing by smoke detection in accordance with Section 716.5.9.3, shall be installed in accordance with NFPA 80 and shall comply with Section 716.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.

**1008.1.4.4 Security grilles.** In Groups B, F, M and S, horizontal sliding or vertical security grilles are permitted at the main exit and shall be openable from the inside without the use of a key or special knowledge or effort during periods that the space is occupied. The grilles shall remain secured in the full-open position during the period of occupancy by the general public. Where two or more means of egress are required, not more than one-half of the exits or exit access doorways shall be equipped with horizontal sliding or vertical security grilles.

**1008.1.5 Floor elevation.** There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope).

**Exceptions:**

1. Doors serving individual dwelling units in Groups R-2 and R-3 where the following apply:
  - 1.1. A door is permitted to open at the top step of an interior flight of stairs, provided the door does not swing over the top step.
  - 1.2. Screen doors and storm doors are permitted to swing over stairs or landings.
2. Exterior doors as provided for in Section 1003.5, Exception 1, and Section 1020.2, which are not on an accessible route.
3. In Group R-3 occupancies not required to be *adaptable or accessible*, the landing at an exterior doorway shall not be more than 7<sup>3</sup>/<sub>4</sub> inches (197 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door, does not swing over the landing.
4. Variations in elevation due to differences in finish materials, but not more than 1/2 inch (12.7 mm).

**1008.1.6 Landings at doors.** Landings shall have a width not less than the width of the stairway or the door, whichever is greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). When a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to

less than one-half its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

**Exception:** Landing length in the direction of travel in Groups R-3 and U and within individual units of Group R-2 need not exceed 36 inches (914 mm).

**1008.1.7 Thresholds.** Thresholds at doorways shall not exceed  $\frac{3}{4}$  inch (19.1 mm) in height above the finished floor or landing for sliding doors serving dwelling units or  $\frac{1}{2}$  inch (12.7 mm) above the finished floor or landing for other doors. Raised thresholds and floor level changes greater than  $\frac{1}{4}$  inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-percent slope).

**Exception:** In occupancy Group R-2 or R-3, threshold heights for sliding and side-hinged exterior doors shall be permitted to be up to  $7\frac{3}{4}$  inches (197 mm) in height if all of the following apply:

1. The door is not part of the required means of egress.
2. The door is not part of an accessible route as required by Chapter 11A or 11B.
3. The door is not part of an *adaptable or accessible dwelling unit*.

**1008.1.8 Door arrangement.** Space between two doors in a series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors.

**Exceptions:**

1. The minimum distance between horizontal sliding power-operated doors in a series shall be 48 inches (1219 mm).
2. Storm and screen doors serving individual dwelling units in Groups R-2 and R-3 need not be spaced 48 inches (1219 mm) from the other door.
3. Doors within individual dwelling units in Groups R-2 and R-3 other than *adaptable or accessible dwelling units*.

**1008.1.9 Door operations.** Except as specifically permitted by this section egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

**1008.1.9.1 Hardware.** Door handles, pulls, latches, locks and other operating devices on doors required to be accessible by Chapter 11A or 11B shall not require tight grasping, tight pinching or twisting of the wrist to operate.

*These design requirements for door handles, pulls, latches, locks and other operating devices, intended for use on required means of egress doors in other than Group R and M occupancies with an occupant load of 10 or less, shall comply with SFM Standard 12-10-2, Section 12-10-202 contained in the CCR, Title 24, Part 12, California Referenced Standards Code.*

**1008.1.9.2 Hardware height.** Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the finished floor. Locks used only for security purposes and not used for normal operation are permitted at any height.

**Exception:** Access doors or gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the release of latch on self-latching devices at 54 inches (1370 mm) maximum above the finished floor or ground, provided the self-latching devices are not also self-locking devices operated by means of a key, electronic opener or integral combination lock.

**1008.1.9.3 Locks and latches.** Locks and latches shall be permitted to prevent operation of doors where any of the following exists:

1. Places of detention or restraint.
2. In buildings in occupancy Group A having an occupant load of 300 or less, Groups B, F, M and S, and in places of religious worship, the main exterior door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
  - 2.1. The locking device is readily distinguishable as locked;
  - 2.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED. The sign shall be in letters 1 inch (25 mm) high on a contrasting background; and
  - 2.3. The use of the key-operated locking device is revokable by the building official for due cause.
3. Where egress doors are used in pairs, approved automatic flush bolts shall be permitted to be used, provided that the door leaf having the automatic flush bolts has no doorknob or surface-mounted hardware.
4. Doors from individual dwelling or sleeping units of Group R occupancies having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.
5. Fire doors after the minimum elevated temperature has disabled the unlatching mechanism in accordance with listed fire door test procedures.

**1008.1.9.4 Bolt locks.** Manually operated flush bolts or surface bolts are not permitted.

**Exceptions:**

1. On doors not required for egress in individual dwelling units or sleeping units.

2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf.
3. Where a pair of doors serves an occupant load of less than 50 persons in a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf. The inactive leaf shall contain no doorknobs, panic bars or similar operating hardware.
4. Where a pair of doors serves a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf provided such inactive leaf is not needed to meet egress width requirements and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The inactive leaf shall contain no doorknobs, panic bars or similar operating hardware.
5. Where a pair of doors serves patient care rooms in Group I-2 occupancies, self-latching edge- or surface-mounted bolts are permitted on the inactive leaf provided that the inactive leaf is not needed to meet egress width requirements and the inactive leaf contains no doorknobs, panic bars or similar operating hardware.

**1008.1.9.5 Unlatching.** The unlatching of any door or leaf shall not require more than one operation.

**Exceptions:**

1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by Section 1008.1.9.4.
3. Doors with automatic flush bolts as permitted by Section 1008.1.9.3, Exception 3.
4. Doors from individual dwelling units and sleeping units of Group R occupancies as permitted by Section 1008.1.9.3, Exception 4.

**1008.1.9.5.1 Closet and bathroom doors in Group R-4 occupancies.** In Group R-4 occupancies, closet doors that latch in the closed position shall be openable from inside the closet, and bathroom doors that latch in the closed position shall be capable of being unlocked from the ingress side.

**1008.1.9.6 Reserved.**

**1008.1.9.7 Delayed egress locks.** Approved, listed, delayed egress locks shall be permitted to be installed on doors serving any occupancy except Group A, E, H and L occupancies.

**Exception:** Group A occupancy courtrooms are permitted to utilize delayed egress locks.

Buildings with delayed egress locks shall be equipped throughout with an automatic sprinkler sys-

tem in accordance with Section 903.3.1.1 and an approved automatic smoke detection system installed in accordance with Section 907, provided that the doors unlock in accordance with Items 1 through 9 below. A building occupant shall not be required to pass through more than one door equipped with a delayed egress lock before entering an exit. *Delayed egress devices shall conform to all of the following:*

1. The doors unlock upon actuation of the automatic sprinkler system or automatic fire detection system.
2. The doors unlock upon loss of *electrical* power to *an one of the following:*
  - 2.1. *The egress-control device itself.*
  - 2.2. *The smoke detection system.*
  - 2.3. *Means of egress illumination as required by Section 1006.*
3. The door locks shall have the capability of being unlocked by a signal from *a switch located in an approved location.*
4. The initiation of an irreversible process which will release the latch in not more than 15 seconds when a force of not more than 15 pounds (67 N) is applied for 1 second to the release device. Initiation of the irreversible process shall activate an audible signal in the vicinity of the door. Once the door lock has been released by the application of force to the releasing device, relocking shall be by manual means only. *The time delay established for each egress-control device shall not be field adjustable. For applications listed in Section 1.9.1 regulated by the Division of the State Architect- Access Compliance, see Chapter 11B, 11B-404.2.9.*

**Exception:** *In facilities housing Alzheimer's or dementia clients, a delay of not more than 30 seconds is permitted.*
5. A sign shall be provided on the door located above and within 12 inches (305 mm) of the release device reading: "KEEP PUSHING. THIS DOOR WILL OPEN IN 15 [30] SECONDS. ALARM WILL SOUND" *Sign lettering shall be at least 1 inch (25 mm) in height and shall have a stroke of not less than 1/8 inch (3.2 mm).*
  - 5.1. *A tactile sign shall also be provided in Braille and raised characters, which complies with Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.*
6. Emergency lighting shall be provided at the door.
7. *Actuation of the panic bar or other door-latching hardware shall activate an audible signal at the door.*
8. *The unlatching shall not require more than one operation.*

9. *Regardless of the means of deactivation, relocking of the egress-control device shall be by manual means only at the door.*

**1008.1.9.8 Access-controlled egress doors.** The entrance doors in a means of egress in buildings with an occupancy in Group A, B, I-2, M, R-1 or R-2 and entrance doors to tenant spaces in occupancies in Groups A, B, I-2, M, R-1 and R-2, are permitted to be equipped with an approved entrance and egress access control system, listed in accordance with UL 294, which shall be installed in accordance with all of the following criteria:

1. A sensor shall be provided on the egress side arranged to detect an occupant approaching the doors. The doors shall be arranged to unlock by a signal from or loss of power to the sensor.
2. Loss of power to that part of the access control system which locks the doors shall automatically unlock the doors.
3. The doors shall be arranged to unlock from a manual unlocking device located 40 inches to 48 inches (1016 mm to 1219 mm) vertically above the floor and within 5 feet (1524 mm) of the secured doors. Ready access shall be provided to the manual unlocking device and the device shall be clearly identified by a sign that reads "PUSH TO EXIT." When operated, the manual unlocking device shall result in direct interruption of power to the lock—independent of the access control system electronics—and the doors shall remain unlocked for a minimum of 30 seconds.
4. Activation of the building fire alarm system, if provided, shall automatically unlock the doors, and the doors shall remain unlocked until the fire alarm system has been reset.
5. Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors. The doors shall remain unlocked until the fire alarm system has been reset.
6. Entrance doors in buildings with an occupancy in Group A, B, I-2 or M shall not be secured from the egress side during periods that the building is open to the general public.

**1008.1.9.9 Electromagnetically locked egress doors.** Doors in the means of egress in buildings with an occupancy in Group A, B, E, M, R-1 or R-2, and doors to tenant spaces in Group A, B, E, M, R-1 or R-2, shall be permitted to be electromagnetically locked if equipped with listed hardware that incorporates a built-in switch and meet the requirements below:

1. The listed hardware that is affixed to the door leaf has an obvious method of operation that is readily operated under all lighting conditions.
2. The listed hardware is capable of being operated with one hand.

3. Operation of the listed hardware directly interrupts the power to the electromagnetic lock and unlocks the door immediately.
4. Loss of power to the listed hardware automatically unlocks the door.
5. Where panic or fire exit hardware is required by Section 1008.1.10, operation of the listed panic or fire exit hardware also releases the electromagnetic lock.

**1008.1.9.10 Reserved.**

**1008.1.9.11 Stairway doors.** Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.

**Exceptions:**

1. Stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. This section shall not apply to doors arranged in accordance with Section 403.5.3.
3. In stairways serving not more than four stories, doors are permitted to be locked from the side opposite the egress side, provided they are openable from the egress side and capable of being unlocked simultaneously without unlatching upon a signal from the fire command center, if present, or a signal by emergency personnel from a single location inside the main entrance to the building.
4. Stairway exit doors shall be openable from the egress side and shall only be locked from the opposite side in Group B, F, M and S occupancies where the only interior access to the tenant space is from a single exit stair where permitted in Section 1021.2.
5. Stairway exit doors shall be openable from the egress side and shall only be locked from the opposite side in Group R-2 occupancies where the only interior access to the dwelling unit is from a single exit stair where permitted in Section 1021.2.

**1008.1.9.12 Access-controlled elevator lobby doors in high-rise office buildings.** For elevator lobbies in high-rise office buildings where the occupants of the floor are not required to travel through the elevator lobby to reach an exit, when approved by the fire chief, the doors separating the elevator lobby from the adjacent occupied tenant space that also serve as the entrance doors to the tenant space shall be permitted to be equipped with an approved entrance and egress access control system provided all of the following requirements are met:

1. The building is provided throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. A smoke detector is installed on the ceiling on the tenant side of the elevator lobby doors along the



center line of the door opening, not less than 1 foot and not more than 5 feet from the door opening, and is connected to the fire alarm system.

3. A remote master switch capable of unlocking the elevator lobby doors shall be provided in the fire command center for use by the fire department.
4. Locks for the elevator lobby shall be U.L. and California State Fire Marshal listed fail-safe type locking mechanisms. The locking device shall automatically release on activation of any fire alarm device on the floor of alarm (waterflow, smoke detector, manual pull stations, etc.). All locking devices shall unlock, but not unlatch, upon activation.
5. A two-way voice communication system, utilizing dedicated lines, shall be provided from each locked elevator lobby to the 24-hour staffed location on site, annunciated as to location. Operating instructions shall be posted above each two-way communication device.

**Exception:** When approved by the fire chief, two-way voice communication system to an off-site facility may be permitted where means to remotely unlock the access controlled doors from the off-site facility are provided.

6. An approved momentary mushroom-shaped palm button connected to the doors and installed adjacent to each locked elevator lobby door shall be provided to release the door locks when operated by an individual in the elevator lobby. The locks shall be reset manually at the door. Mount palm button so that the center line is 48 inches above the finished floor.

Provide a sign stating:

“IN CASE OF EMERGENCY,  
PUSH PALM BUTTON,  
DOOR WILL UNLOCK AND  
SECURITY ALARM WILL  
SOUND.”

The sign lettering shall be  $\frac{3}{4}$ -inch high letters by  $\frac{1}{8}$ -inch width stroke on a contrasting background.

7. Loss of power to that part of the access control system which locks the doors shall automatically unlock the doors.

**1008.1.10 Panic and fire exit hardware.** Doors serving a Group H occupancy and doors serving rooms or spaces with an occupant load of 50 or more in a Group A occupancy, assembly area not classified as an assembly occupancy, E, I-2 or I-2.1 occupancies shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware. For Group L occupancies see Section 443.6.3.

**Exception:** A main exit of a Group A occupancy in compliance with Section 1008.1.9.3, Item 2.

Electrical rooms with equipment rated 1,200 amperes or more and over 6 feet (1829 mm) wide that contain over-

current devices, switching devices or control devices with exit or exit access doors shall be equipped with panic hardware or fire exit hardware. The doors shall swing in the direction of egress travel.

**1008.1.10.1 Installation.** Where panic or fire exit hardware is installed, it shall comply with the following:

1. Panic hardware shall be listed in accordance with UL 305;
2. Fire exit hardware shall be listed in accordance with UL 10C and UL 305;
3. The actuating portion of the releasing device shall extend at least one-half of the door leaf width; and
4. The maximum unlatching force shall not exceed 15 pounds (67 N).

**1008.1.10.2 Balanced doors.** If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend more than one-half the width of the door measured from the latch side.

**1008.1.11 Group E lockable doors from the inside.** New buildings that are included in public school kindergarten through 12th grade state funded projects and receiving state funding pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079, and that are submitted to the Division of the State Architect for plan review after July 1, 2011 in accordance with Education Code 17075.50, shall include locks that allow doors to classrooms and any room with an occupancy of five or more persons to be locked from the inside. The locks shall conform to the specification and requirements found in Section 1008.1.9

**Exceptions:**

1. Doors that are locked from the outside at all times such as, but not limited to, janitor's closet, electrical room, storage room, boiler room, elevator equipment room and pupil restroom.
2. Reconstruction projects that utilize original plans in accordance with California Administrative Code, Section 4-314.
3. Existing relocatable buildings that are relocated within same site in accordance with California Administrative Code, Section 4-314.

**1008.2 Gates.** Gates serving the means of egress system shall comply with the requirements of this section. Gates used as a component in a means of egress shall conform to the applicable requirements for doors.

**Exception:** Horizontal sliding or swinging gates exceeding the 4-foot (1219 mm) maximum leaf width limitation are permitted in fences and walls surrounding a stadium.

**1008.2.1 Stadiums.** Panic hardware is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and where safe dispersal areas based on 3 square feet (0.28 m<sup>2</sup>) per occupant are located between the fence and

enclosed space. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the enclosed space. See Section 1027.5 for means of egress from safe dispersal areas.

**1008.3 Turnstiles.** Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required means of egress.

**Exception:** Each turnstile or similar device shall be credited with no more than a 50-person capacity where all of the following provisions are met:

1. Each device shall turn free in the direction of egress travel when primary power is lost, and upon the manual release by an employee in the area.
2. Such devices are not given credit for more than 50 percent of the required egress capacity.
3. Each device is not more than 39 inches (991 mm) high.
4. Each device has at least 16 $\frac{1}{2}$  inches (419 mm) clear width at and below a height of 39 inches (991 mm) and at least 22 inches (559 mm) clear width at heights above 39 inches (991 mm).

Where located as part of an accessible route, turnstiles shall have at least 36 inches (914 mm) clear at and below a height of 34 inches (864 mm), at least 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032 mm) and shall consist of a mechanism other than a revolving device.

**1008.3.1 High turnstile.** Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors.

**1008.3.2 Additional door.** Where serving an occupant load greater than 300, each turnstile that is not portable shall have a side-hinged swinging door which conforms to Section 1008.1 within 50 feet (15 240 mm).

## SECTION 1009 STAIRWAYS

*[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*

**1009.1 General.** Stairways serving occupied portions of a building shall comply with the requirements of this section.

**1009.2 Interior exit stairways.** Interior exit stairways shall lead directly to the exterior of the building or shall be extended to the exterior of the building with an exit passageway conforming to the requirements of Section 1023, except as permitted in Section 1027.1.

**1009.2.1 Where required.** Interior exit stairways shall be included, as necessary, to meet one or more means of

egress design requirements, such as required number of exits or exit access travel distance.

**1009.2.2 Enclosure.** All interior exit stairways shall be enclosed in accordance with the provisions of Section 1022.

**1009.3 Exit access stairways.** Floor openings between stories created by exit access stairways shall be enclosed.

### Exceptions:

1. In other than Group I-2, *I-2.1*, I-3 and *R-2.1* occupancies, exit access stairways that serve, or atmospherically communicate between, only two stories are not required to be enclosed.
2. Exit access stairways serving and contained within a single residential dwelling unit or sleeping unit in Group R-1, R-2 or R-3 occupancies are not required to be enclosed.
3. In buildings with only Group B or M occupancies, exit access stairway openings are not required to be enclosed provided that the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the area of the floor opening between stories does not exceed twice the horizontal projected area of the exit access stairway, and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13.
4. In other than Group B, *I-2*, *I-2.1*, *I-3* and M occupancies, exit access stairway openings are not required to be enclosed provided that the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the floor opening does not connect more than four stories, the area of the floor opening between stories does not exceed twice the horizontal projected area of the exit access stairway, and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13.
5. Exit access stairways within an atrium complying with the provisions of Section 404 are not required to be enclosed.
6. Exit access stairways and ramps in open parking garages that serve only the parking garage are not required to be enclosed.
7. Stairways serving outdoor facilities where all portions of the means of egress are essentially open to the outside are not required to be enclosed.
8. Exit access stairways serving stages, platforms and technical production areas in accordance with Sections 410.6.2 and 410.6.3 are not required to be enclosed.
9. Stairways are permitted to be open between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.

10. In Group I-3 occupancies, exit access stairways constructed in accordance with Section 408.5 are not required to be enclosed.

11. *Fixed guideway transit stations, constructed in accordance with Section 433.*

**1009.3.1 Construction.** Where required, enclosures for exit access stairways shall be constructed in accordance with this section. Exit access stairway enclosures shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies in accordance with Section 711, or both.

**1009.3.1.1 Materials.** Exit access stairway enclosures shall be of materials permitted by the building type of construction.

**1009.3.1.2 Fire-resistance rating.** Exit access stairway enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the exit access stairway enclosures shall include any basements, but not any mezzanines. Exit access stairway enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.

**1009.3.1.3 Continuity.** Exit access stairway enclosures shall have continuity in accordance with Section 707.5 for fire barriers or Section 711.4 for horizontal assemblies as applicable.

**1009.3.1.4 Openings.** Openings in an exit access stairway enclosure shall be protected in accordance with Section 716 as required for fire barriers. Doors shall be self- or automatic-closing by smoke detection in accordance with Section 716.5.9.3.

**1009.3.1.4.1 Prohibited openings.** Openings other than those necessary for the purpose of the exit access stairway enclosure shall not be permitted in exit access stairway enclosures.

**1009.3.1.5 Penetrations.** Penetrations in an exit access stairway enclosure shall be protected in accordance with Section 714 as required for fire barriers.

**1009.3.1.5.1 Prohibited penetrations.** Penetrations other than those necessary for the purpose of the exit access stairway enclosure shall not be permitted in exit access stairway enclosures.

**1009.3.1.6 Joints.** Joints in an exit access stairway enclosure shall comply with Section 715.

**1009.3.1.7 Ducts and air transfer openings.** Penetrations of an exit access stairway enclosure by ducts and air transfer openings shall comply with Section 717.

**1009.3.1.8 Exterior walls.** Where exterior walls serve as a part of an exit access stairway enclosure, such walls shall comply with the requirements of Section 705 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

**1009.4 Width.** The width of stairways shall be determined as specified in Section 1005.1, but such width shall not be less

than 44 inches (1118 mm). See Section 1007.3 for accessible means of egress stairways.

#### Exceptions:

1. Stairways serving an occupant load of less than 50 shall have a width of not less than 36 inches (914 mm).
2. Spiral stairways as provided for in Section 1009.12.
3. Aisle stairs complying with Section 1028.
4. Where an incline platform lift or stairway chairlift is installed on stairways serving occupancies in Group R-3, or within dwelling units in occupancies in Group R-2, a clear passage width not less than 20 inches (508 mm) shall be provided. If the seat and platform can be folded when not in use, the distance shall be measured from the folded position.

*Means of egress stairs in a Group I-2 occupancy used for the movement of beds and litter patients shall provide a clear width not less than 44 inches (1118 mm).*

**1009.5 Headroom.** Stairways shall have a minimum headroom clearance of 80 inches (2032 mm) measured vertically from a line connecting the edge of the nosings. Such headroom shall be continuous above the stairway to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the stairway and landing.

#### Exceptions:

1. Spiral stairways complying with Section 1009.12 are permitted a 78-inch (1981 mm) headroom clearance.
2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom a maximum of  $4\frac{3}{4}$  inches (121 mm).

**1009.6 Walkline.** The walkline across winder treads shall be concentric to the direction of travel through the turn and located 12 inches (305 mm) from the side where the winders are narrower. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. If winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used.

**1009.7 Stair treads and risers.** Stair treads and risers shall comply with Sections 1009.7.1 through 1009.7.5.3.

**1009.7.1 Dimension reference surfaces.** For the purpose of this section, all dimensions are exclusive of carpets, rugs or runners.

**1009.7.2 Riser height and tread depth.** Stair riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. The riser height shall be measured verti-

cally between the nosings of adjacent treads. Rectangular tread depths shall be 11 inches (279 mm) minimum measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's nosing. Winder treads shall have a minimum tread depth of 11 inches (279 mm) between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline and a minimum tread depth of 10 inches (254 mm) within the clear width of the stair.

**Exceptions:**

1. Alternating tread devices in accordance with Section 1009.13.
2. Ship ladders in accordance with Section 1009.14.
3. Spiral stairways in accordance with Section 1009.12.
4. Aisle stairs in assembly seating areas where the stair pitch or slope is set, for sightline reasons, by the slope of the adjacent seating area in accordance with Section 1028.11.2.
5. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; the maximum riser height shall be  $7\frac{3}{4}$  inches (197 mm); the minimum tread depth shall be 10 inches (254 mm); the minimum winder tread depth at the walkline shall be 10 inches (254 mm); and the minimum winder tread depth shall be 6 inches (152 mm). A nosing projection not less than  $\frac{3}{4}$  inch (19.1 mm) but not more than  $1\frac{1}{4}$  inches (32 mm) shall be provided on stairways with solid risers where the tread depth is less than 11 inches (279 mm).
6. See Section 3404.1 for the replacement of existing stairways. *[DSA-AC] For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, Section 11B-202.*
7. In Group I-3 facilities, stairways providing access to guard towers, observation stations and control rooms, not more than 250 square feet (23 m<sup>2</sup>) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).
8. *[SFM] Stairways providing access to lifeguard towers not open to the public, not more than 250 square feet (23 m<sup>2</sup>) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).*

**1009.7.3 Winder treads.** Winder treads are not permitted in means of egress stairways except within a dwelling unit.

**Exceptions:**

1. Curved stairways in accordance with Section 1009.11.

2. Spiral stairways in accordance with Section 1009.12.

**1009.7.4 Dimensional uniformity.** Stair treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser height or between the largest and smallest tread depth shall not exceed  $\frac{3}{8}$  inch (9.5 mm) in any flight of stairs. The greatest winder tread depth at the walkline within any flight of stairs shall not exceed the smallest by more than  $\frac{3}{8}$  inch (9.5 mm).

**Exceptions:**

1. Nonuniform riser dimensions of aisle stairs complying with Section 1028.11.2.
2. Consistently shaped winders, complying with Section 1009.7, differing from rectangular treads in the same stairway flight.

Where the bottom or top riser adjoins a sloping public way, walkway or driveway having an established grade and serving as a landing, the bottom or top riser is permitted to be reduced along the slope to less than 4 inches (102 mm) in height, with the variation in height of the bottom or top riser not to exceed one unit vertical in 12 units horizontal (8-percent slope) of stairway width. The nosings or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other nosing marking provided on the stair flight. The distinctive marking stripe shall be visible in descent of the stair and shall have a slip-resistant surface. Marking stripes shall have a width of at least 1 inch (25 mm) but not more than 2 inches (51 mm).

**1009.7.5 Nosing and riser profile.** The radius of curvature at the leading edge of the tread shall be not greater than  $\frac{9}{16}$  inch (14.3 mm). Beveling of nosings shall not exceed  $\frac{9}{16}$  inch (14.3 mm). Risers shall be solid and vertical or sloped under the tread above from the underside of the nosing above at an angle not more than 30 degrees (0.52 rad) from the vertical.

**1009.7.5.1 Nosing projection size.** The leading edge (nosings) of treads shall project not more than  $1\frac{1}{4}$  inches (32 mm) beyond the tread below.

**1009.7.5.2 Nosing projection uniformity.** All nosing projections of the leading edges shall be of uniform size, including the projections of the nosings leading edge of the floor at the top of a flight.

**1009.7.5.3 Solid risers.** Risers shall be solid.

**Exceptions:**

1. Solid risers are not required for stairways that are not required to comply with Section 1007.3, provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm).
2. Solid risers are not required for occupancies in Group I-3 or in Group F, H and S occupancies other than areas accessible to the public. There are no restrictions on the size of the opening in the riser.

3. Solid risers are not required for spiral stairways constructed in accordance with Section 1009.12.
4. Solid risers are not required for alternating tread devices constructed in accordance with Section 1009.13.

**1009.8 Stairway landings.** There shall be a floor or landing at the top and bottom of each stairway. The width of landings shall not be less than the width of stairways they serve. Every landing shall have a minimum width measured perpendicular to the direction of travel equal to the width of the stairway. Where the stairway has a straight run the depth need not exceed 48 inches (1219 mm). Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than 7 inches (178 mm) into a landing. When wheelchair spaces are required on the stairway landing in accordance with Section 1007.6.1, the wheelchair space shall not be located in the required width of the landing and doors shall not swing over the wheelchair spaces.

**Exceptions:**

1. Aisle stairs complying with Section 1028.
2. *[SFM] In Group R-3 occupancies a floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs.*

**1009.9 Stairway construction.** All stairways shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.

**1009.9.1 Stairway walking surface.** The walking surface of treads and landings of a stairway shall not be sloped steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Stairway treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached.

**Exceptions:**

1. Openings in stair walking surfaces shall be a size that does not permit the passage of  $\frac{1}{2}$ -inch-diameter (12.7 mm) sphere. Elongated openings shall be placed so that the long dimension is perpendicular to the direction of travel.
2. In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided a sphere with a diameter of  $1\frac{1}{8}$  inches (29 mm) cannot pass through the opening.

**1009.9.2 Outdoor conditions.** Outdoor stairways and outdoor approaches to stairways shall be designed so that water will not accumulate on walking surfaces.

**1009.9.3 Enclosures under interior stairways.** The walls and soffits within enclosed usable spaces under enclosed and unenclosed stairways shall be protected by 1-hour fire-resistance-rated construction or the fire-resistance rating of the stairway enclosure, whichever is greater. Access

to the enclosed space shall not be directly from within the stair enclosure.

**Exception:** Spaces under stairways serving and contained within a single residential dwelling unit in Group R-2 or R-3 shall be permitted to be protected on the enclosed side with  $\frac{1}{2}$ -inch (12.7 mm) gypsum board.

**1009.9.4 Enclosures under exterior stairways.** There shall be no enclosed usable space under exterior exit stairways unless the space is completely enclosed in 1-hour fire-resistance-rated construction. The open space under exterior stairways shall not be used for any purpose.

**1009.10 Vertical rise.** A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

**Exceptions:**

1. Aisle stairs complying with Section 1028.
2. Alternating tread devices used as a means of egress shall not have a rise greater than 20 feet (6096 mm) between floor levels or landings.
3. Spiral stairways used as a means of egress from technical production areas.

**1009.11 Curved stairways.** Curved stairways with winder treads shall have treads and risers in accordance with Section 1009.7 and the smallest radius shall not be less than twice the required width of the stairway.

**Exception:** The radius restriction shall not apply to curved stairways for occupancies in Group R-3 and within individual dwelling units in occupancies in Group R-2.

**1009.12 Spiral stairways.** Spiral stairways are permitted to be used as a component in the means of egress only within dwelling units or from a space not more than 250 square feet (23 m<sup>2</sup>) in area and serving not more than five occupants, or from technical production areas in accordance with Section 410.6.

A spiral stairway shall have a  $7\frac{1}{2}$ -inch (191 mm) minimum clear tread depth at a point 12 inches (305 mm) from the narrow edge. The risers shall be sufficient to provide a headroom of 78 inches (1981 mm) minimum, but riser height shall not be more than  $9\frac{1}{2}$  inches (241 mm). The minimum stairway clear width at and below the handrail shall be 26 inches (660 mm).

**1009.13 Alternating tread devices.** Alternating tread devices are limited to an element of a means of egress in buildings of Groups F, H and S from a mezzanine not more than 250 square feet (23 m<sup>2</sup>) in area and which serves not more than five occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m<sup>2</sup>) in area and for access to unoccupied roofs.

**1009.13.1 Handrails of alternating tread devices.** Handrails shall be provided on both sides of alternating tread devices and shall comply with Section 1012.

**1009.13.2 Treads of alternating tread devices.** Alternating tread devices shall have a minimum tread depth of 5 inches (127 mm), a minimum projected tread depth of  $8\frac{1}{2}$

inches (216 mm), a minimum tread width of 7 inches (178 mm) and a maximum riser height of 9½ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

**Exception:** Alternating tread devices used as an element of a means of egress in buildings from a mezzanine area not more than 250 square feet (23 m²) in area which serves not more than five occupants shall have a minimum tread depth of 3 inches (76 mm) with a minimum projected tread depth of 10½ inches (267 mm). The rise to the next alternating tread surface shall not exceed 8 inches (203 mm).

**1009.14 Ship ladders.** Ship ladders are permitted to be used in Group I-3 as a component of a means of egress to and from control rooms or elevated facility observation stations not more than 250 square feet (23 m²) with not more than three occupants and for access to unoccupied roofs.

Ship ladders shall have a minimum tread depth of 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the nosing projection is no less than 8½ inches (216 mm). The maximum riser height shall be 9½ inches (241 mm).

Handrails shall be provided on both sides of ship ladders. The minimum clear width at and below the handrails shall be 20 inches (508 mm).

**1009.15 Handrails.** Stairways shall have handrails on each side and shall comply with Section 1012. Where glass is used to provide the handrail, the handrail shall also comply with Section 2407.

*[DSA-AC] For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, Sections 11B-504.6 and 11B-505.*

**Exceptions:**

1. Handrails for aisle stairs provided in accordance with Section 1028.13.
2. Stairways within dwelling units and spiral stairways are permitted to have a handrail on one side only.
3. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails.
4. *[SFM] In Group R-3 occupancies, a continuous run of treads or flight of stairs with less than four risers does not require handrails.*
5. Changes in room elevations of three or fewer risers within dwelling units and sleeping units in Groups R-2 and R-3 do not require handrails.

**1009.16 Stairway to roof.** In buildings four or more stories above grade plane, one stairway shall extend to the roof surface, unless the roof has a slope steeper than four units vertical in 12 units horizontal (33-percent slope). In buildings without an occupied roof, access to the roof from the top story shall be permitted to be by an alternating tread device.

**1009.16.1 Roof access.** Where a stairway is provided to a roof, access to the roof shall be provided through a penthouse complying with Section 1509.2.

**Exception:** In buildings without an occupied roof, access to the roof shall be permitted to be a roof hatch or trap door not less than 16 square feet (1.5 m²) in area and having a minimum dimension of 2 feet (610 mm).

**1009.16.2 Protection at roof hatch openings.** Where the roof hatch opening providing the required access is located within 10 feet (3049 mm) of the roof edge, such roof access or roof edge shall be protected by guards installed in accordance with the provisions of Section 1013.

**1009.17 Stairway to elevator equipment.** Roofs and penthouses containing elevator equipment that must be accessed for maintenance are required to be accessed by a stairway.

## SECTION 1010 RAMPS

*[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 11B-405, as applicable.*

**1010.1 Scope.** The provisions of this section shall apply to ramps used as a component of a means of egress.

**Exceptions:**

1. Other than ramps that are part of the accessible routes providing access in accordance with Chapter 11A or 11B, ramped aisles within assembly rooms or spaces shall conform with the provisions in Section 1028.11.
2. Curb ramps shall comply with Chapter 11A or 11B, 11B-406, as applicable.
3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with Sections 1010.4 through 1010.10 when they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.

**1010.2 Enclosure.** All interior exit ramps shall be enclosed in accordance with the applicable provisions of Section 1022. Exit access ramps shall be enclosed in accordance with the provisions of Section 1009.3 for enclosure of stairways.

**1010.3 Slope.** Ramps used as part of a means of egress shall have a running slope not steeper than one unit vertical in 12 units horizontal (8-percent slope). The slope of other pedes-

trian ramps shall not be steeper than one unit vertical in eight units horizontal (12.5-percent slope).

**Exception:** Aisle ramp slope in a room or space used for assembly purposes shall comply with Section 1028.11.

**1010.4 Cross slope.** The slope measured perpendicular to the direction of travel of a ramp shall not be steeper than one unit vertical in 48 units horizontal (2-percent slope).

**1010.5 Vertical rise.** The rise for any ramp run shall be 30 inches (762 mm) maximum.

**1010.6 Minimum dimensions.** The minimum dimensions of means of egress ramps shall comply with Sections 1010.6.1 through 1010.6.3.

**1010.6.1 Width.** The minimum width of a means of egress ramp shall not be less than that required for corridors by Section 1018.2. The clear width of a ramp between handrails, if provided, or other permissible projections shall be 36 inches (914 mm) minimum.

**1010.6.2 Headroom.** The minimum headroom in all parts of the means of egress ramp shall not be less than 80 inches (2032 mm).

**1010.6.3 Restrictions.** Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

**1010.7 Landings.** Ramps shall have landings at the bottom and top of each ramp, points of turning, entrance, exits and at doors. Landings shall comply with Sections 1010.7.1 through 1010.7.5.

**1010.7.1 Slope.** Landings shall have a slope not steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Changes in level are not permitted.

**1010.7.2 Width.** The landing shall be at least as wide as the widest ramp run adjoining the landing.

**1010.7.3 Length.** The landing length shall be 60 inches (1525 mm) minimum.

**Exceptions:**

1. In Group R-2 and R-3 individual dwelling and sleeping units that are not required to be *accessible* in accordance with *Chapter 11A*, landings are permitted to be 36 inches (914 mm) minimum.
2. Where the ramp is not a part of an accessible route, the length of the landing shall not be required to be more than 48 inches (1220 mm) in the direction of travel.

**1010.7.4 Change in direction.** Where changes in direction of travel occur at landings provided between ramp runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.

**Exception:** In Group R-2 and R-3 individual dwelling or sleeping units that are not required to be *accessible*

in accordance with *Chapter 11A*, landings are permitted to be 36 inches by 36 inches (914 mm by 914 mm) minimum.

**1010.7.5 Doorways.** Where doorways are located adjacent to a ramp landing, maneuvering clearances required for *accessibility* are permitted to overlap the required landing area as specified in *Chapter 11A*.

**1010.8 Ramp construction.** All ramps shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.

**1010.8.1 Ramp surface.** The surface of ramps shall be of slip-resistant materials that are securely attached.

**1010.8.2 Outdoor conditions.** Outdoor ramps and outdoor approaches to ramps shall be designed so that water will not accumulate on walking surfaces.

**1010.9 Handrails.** Ramps with a rise greater than 6 inches (152 mm) shall have handrails on both sides. Handrails shall comply with Section 1012.

**Exception:** Handrails for ramped aisles provided in accordance with Section 1028.13.

**1010.10 Edge protection.** Edge protection complying with Section 1010.10.1 or 1010.10.2 shall be provided on each side of ramp runs and at each side of ramp landings.

**Exceptions:**

1. Edge protection is not required on ramps that are not required to have handrails, provided they have flared sides that comply with *Chapter 11A or 11B*.
2. Edge protection is not required on the sides of ramp landings serving an adjoining ramp run or stairway.
3. Edge protection is not required on the sides of ramp landings having a vertical drop off of not more than  $\frac{1}{2}$  inch (12.7 mm) within 10 inches (254 mm) horizontally of the required landing area.
4. In assembly spaces with fixed seating, edge protection is not required on the sides of ramps where the ramps provide access to the adjacent seating and aisle accessways.

**1010.10.1 Curb, rail, wall or barrier.** A curb, rail, wall or barrier shall be provided to serve as edge protection. A curb must be a minimum of 4 inches (102 mm) in height. Barriers must be constructed so that the barrier prevents the passage of a 4-inch-diameter (102 mm) sphere, where any portion of the sphere is within 4 inches (102 mm) of the floor or ground surface.

**1010.10.2 Extended floor or ground surface.** The floor or ground surface of the ramp run or landing shall extend 12 inches (305 mm) minimum beyond the inside face of a handrail complying with Section 1012.

**1010.11 Guards.** Guards shall be provided where required by Section 1013 and shall be constructed in accordance with Section 1013.

## SECTION 1011 EXIT SIGNS

**1011.1 Where required.** Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. The path of egress travel to exits and within exits shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within exits shall be marked by exit signs. Exit sign placement shall be such that no point in an exit access corridor or exit passageway is more than 100 feet (30 480 mm) or the listed viewing distance for the sign, whichever is less, from the nearest visible exit sign.

### Exceptions:

1. Exit signs are not required in rooms or areas that require only one exit or exit access.
2. Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not have exit signs where approved by the building official.
3. Exit signs are not required in occupancies in Group U and individual sleeping units or dwelling units in Group R-1, R-2, R-3 or R-3.1.
4. Exit signs are not required *where inmates are housed, or held* in dayrooms, sleeping rooms or dormitories in occupancies in Group I-3.
5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.

**1011.2 Floor-level exit signs in Group R-1.** *See Section 1011.7.*

**1011.3 Illumination.** Exit signs shall be internally or externally illuminated.

**Exception:** Tactile signs required by Section 1011.4 need not be provided with illumination.

**1011.4 Raised character and Braille exit signs.** *Tactile exit signs shall be required at the following locations:*

1. *Each grade-level exterior exit door that is required to comply with Section 1011.1, shall be identified by a tactile exit sign with the word, "EXIT."*
2. *Each exit door that is required to comply with Section 1011.1, and that leads directly to a grade-level exterior exit by means of a stairway or ramp shall be identified by a tactile exit sign with the following words as appropriate:*
  - 2.1. "EXIT STAIR DOWN"
  - 2.2. "EXIT RAMP DOWN"
  - 2.3. "EXIT STAIR UP"
  - 2.4. "EXIT RAMP UP"

3. *Each exit door that is required to comply with Section 1011.1, and that leads directly to a grade-level exterior exit by means of an exit enclosure or an exit passageway shall be identified by a tactile exit sign with the words, "EXIT ROUTE."*
4. *Each exit access door from an interior room or area to a corridor or hallway that is required to comply with Section 1011.1, shall be identified by a tactile exit sign with the words "EXIT ROUTE."*
5. *Each exit door through a horizontal exit that is required to comply with Section 1011.1, shall be identified by a sign with the words, "TO EXIT."*

*Raised character and Braille exit signs shall comply with Chapter 11A, Section 1143A or Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.*

**1011.5 Internally illuminated exit signs.** Electrically powered, self-luminous and photoluminescent exit signs shall be listed and labeled in accordance with UL 924 and shall be installed in accordance with the manufacturer's instructions and Chapter 27. Exit signs shall be illuminated at all times.

**1011.6 Externally illuminated exit signs.** Externally illuminated exit signs shall comply with Sections 1011.6.1 through 1011.6.3.

**1011.6.1 Graphics.** Every exit sign and directional exit sign shall have plainly legible letters not less than 6 inches (152 mm) high with the principal strokes of the letters not less than  $\frac{3}{4}$  inch (19.1 mm) wide. The word "EXIT" shall have letters having a width not less than 2 inches (51 mm) wide, except the letter "I," and the minimum spacing between letters shall not be less than  $\frac{3}{8}$  inch (9.5 mm). Signs larger than the minimum established in this section shall have letter widths, strokes and spacing in proportion to their height.

The word "EXIT" shall be in high contrast with the background and shall be clearly discernible when the means of exit sign illumination is or is not energized. If a chevron directional indicator is provided as part of the exit sign, the construction shall be such that the direction of the chevron directional indicator cannot be readily changed.

**1011.6.2 Exit sign illumination.** The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 footcandles (54 lux).

**1011.6.3 Power source.** Exit signs shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Chapter 27.

**Exception:** Approved exit sign illumination means that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.



**1011.7 Floor-level exit signs.** Where exit signs are required by Chapter 10, additional approved low-level exit signs which are internally or externally illuminated photoluminescent or self-luminous, shall be provided in all interior corridors of Group A, E, I and R-2.1 occupancies and in all areas serving guest rooms of hotels in Group R, Division 1 occupancies.

**Exceptions:**

1. Group A occupancies that are protected throughout by an approved supervised fire sprinkler system.
2. Group E Occupancies where direct exits have been provided from each classroom.
3. Group I and R-2.1 occupancies which are provided with smoke barriers constructed in accordance with Section 407.4
4. Group I-3 occupancies.

The bottom of the sign shall not be less than 6 inches (152 mm) or more than 8 inches (203 mm) above the floor level and shall indicate the path of exit travel. For exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign or marker within 4 inches (102 mm) of the door frame.

**Note:** Pursuant to Health and Safety Code Section 13143, this California amendment applies to all newly constructed buildings or structures subject to this section for which a building permit is issued (or construction commenced, where no building permit is issued) on or after January 1, 1989.

**1011.8 Path marking.** When exit signs are required by Chapter 10, in addition to approved floor-level exit signs, approved path marking shall be installed at floor level or no higher than 8 inches (203 mm) above the floor level in all interior rated exit corridors of unsprinklered Group A, R-1 and R-2 occupancies.

Such marking shall be continuous except as interrupted by door-ways, corridors or other such architectural features in order to provide a visible delineation along the path of travel.

**Note:** Pursuant to Health and Safety Code Section 13143, the California amendments of this section shall apply to all newly constructed buildings or structures subject to this section for which a building permit is issued (or construction commenced, where no building permit is issued) on or after January 1, 1989.

## SECTION 1012 HANDRAILS

**[DSA-AC]** In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 11B-505, as applicable.

**1012.1 Where required.** Handrails for stairways and ramps shall be adequate in strength and attachment in accordance

with Section 1607.8. Handrails required for stairways by Section 1009.15 shall comply with Sections 1012.2 through 1012.9. Handrails required for ramps by Section 1010.9 shall comply with Sections 1012.2 through 1012.8.

**1012.2 Height.** Handrail height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm). Handrail height of alternating tread devices and ship ladders, measured above tread nosings, shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

**Exceptions:**

1. When handrail fittings or bendings are used to provide continuous transition between flights, the fittings or bendings shall be permitted to exceed the maximum height.
2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are associated with a Group R-3 occupancy or associated with individual dwelling units in Group R-2 occupancies; when handrail fittings or bendings are used to provide continuous transition between flights, transition at winder treads, transition from handrail to guard, or when used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.

**1012.3 Handrail graspability.** All required handrails shall comply with Section 1012.3.1 or shall provide equivalent graspability.

**Exception:** In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; handrails shall be Type I in accordance with Section 1012.3.1, Type II in accordance with Section 1012.3.2 or shall provide equivalent graspability.

**1012.3.1 Type I.** Handrails with a circular cross section shall have an outside diameter of at least  $1\frac{1}{4}$  inches (32 mm) and not greater than 2 inches (51 mm). Where the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than  $6\frac{1}{4}$  inches (160 mm) with a maximum cross-sectional dimension of  $2\frac{1}{4}$  inches (57 mm) and minimum cross-sectional dimension of 1 inch (25 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

**1012.3.2 Type II.** Handrails with a perimeter greater than  $6\frac{1}{4}$  inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of  $\frac{3}{4}$  inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least  $\frac{5}{16}$  inch (8 mm) within  $\frac{7}{8}$  inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least  $\frac{3}{8}$  inch (10 mm) to a level that is not less than  $1\frac{3}{4}$  inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be  $1\frac{1}{4}$  inches (32 mm)

to a maximum of  $2\frac{3}{4}$  inches (70 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

**1012.4 Continuity.** Handrail gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

**Exceptions:**

1. Handrails within dwelling units are permitted to be interrupted by a newel post at a turn or landing.
2. Within a dwelling unit, the use of a volute, turnout, starting easing or starting newel is allowed over the lowest tread.
3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within  $1\frac{1}{2}$  inches (38 mm) of the bottom of the handrail shall not be considered obstructions. For each  $\frac{1}{2}$  inch (12.7 mm) of additional handrail perimeter dimension above 4 inches (102 mm), the vertical clearance dimension of  $1\frac{1}{2}$  inches (38 mm) shall be permitted to be reduced by  $\frac{1}{8}$  inch (3 mm).
4. Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of the handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.

**1012.5 Fittings.** Handrails shall not rotate within their fittings.

**1012.6 Handrail extensions.** Handrails shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent stair flight or ramp run. Where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches (305 mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. At ramps where handrails are not continuous between runs, the handrails shall extend horizontally above the landing 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. The extensions of handrails shall be in the same direction of the stair flights at stairways and the ramp runs at ramps.

**Exceptions:**

1. Handrails within a dwelling unit that is not required to be accessible need extend only from the top riser to the bottom riser.
2. Aisle handrails in rooms or spaces used for assembly purposes in accordance with Section 1028.13.
3. Handrails for alternating tread devices and ship ladders are permitted to terminate at a location vertically above the top and bottom risers. Handrails for alternating tread devices and ship ladders are not required to be continuous between flights or to extend beyond the top or bottom risers.

**1012.7 Clearance.** Clear space between a handrail and a wall or other surface shall be a minimum of  $1\frac{1}{2}$  inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

**1012.8 Projections.** On ramps, the clear width between handrails shall be 36 inches (914 mm) minimum. Projections into the required width of stairways and ramps at each side shall not exceed  $4\frac{1}{2}$  inches (114 mm) at or below the handrail height. Projections into the required width shall not be limited above the minimum headroom height required in Section 1009.5. Projections due to intermediate handrails shall not constitute a reduction in the egress width.

*In Group I-2 occupancy ramps required for exit access shall not be less than 8 ft in width and handrails are permitted to protrude  $3\frac{1}{2}$  inches from the wall on both sides. Ramps used as exits and stairways used for the movement of bed and litter patients, the clear width between handrails shall be 44 inches (1118 mm) minimum.*

**1012.9 Intermediate handrails.** Stairways shall have intermediate handrails located in such a manner that all portions of the stairway width required for egress capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.

## SECTION 1013 GUARDS

**1013.1 General.** Guards shall comply with the provisions of Sections 1013.2 through 1013.7. Operable windows with sills located more than 72 inches (1.83 m) above finished grade or other surface below shall comply with Section 1013.8.

**1013.2 Where required.** Guards shall be located along open-sided walking surfaces, including mezzanines, equipment platforms, stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Guards shall be adequate in strength and attachment in accordance with Section 1607.8.

**Exception:** Guards are not required for the following locations:

1. On the loading side of loading docks or piers.
2. On the audience side of stages and raised platforms, including steps leading up to the stage and raised platforms.
3. On raised stage and platform floor areas, such as runways, ramps and side stages used for entertainment or presentations.
4. At vertical openings in the performance area of stages and platforms.
5. At elevated walking surfaces appurtenant to stages and platforms for access to and utilization of special lighting or equipment.
6. Along vehicle service pits not accessible to the public.
7. In assembly seating where guards in accordance with Section 1028.14 are permitted and provided.

**1013.2.1 Glazing.** Where glass is used to provide a guard or as a portion of the guard system, the guard shall also

comply with Section 2407. Where the glazing provided does not meet the strength and attachment requirements of Section 1607.8, complying guards shall also be located along glazed sides of open-sided walking surfaces.

**1013.3 Height.** Required guards shall not be less than 42 inches (1067 mm) high, measured vertically as follows:

1. From the adjacent walking surfaces;
2. On stairs, from the line connecting the leading edges of the tread nosings; and
3. On ramps, from the ramp surface at the guard.

**Exceptions:**

1. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, guards on the open sides of stairs shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
2. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, where the top of the guard also serves as a handrail on the open sides of stairs, the top of the guard shall not be less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.
3. The guard height in assembly seating areas shall comply with Section 1028.14.
4. Along alternating tread devices and ship ladders, guards whose top rail also serves as a handrail, shall have height not less than 30 inches (762 mm) and not more than 34 inches (864 mm), measured vertically from the leading edge of the device tread nosing.

**1013.4 Opening limitations.** Required guards shall not have openings which allow passage of a sphere 4 inches (102 mm) in diameter from the walking surface to the required guard height.

**Exceptions:**

1. From a height of 36 inches (914 mm) to 42 inches (1067 mm), guards shall not have openings which allow passage of a sphere  $4\frac{3}{8}$  inches (111 mm) in diameter.
2. The triangular openings at the open sides of a stair, formed by the riser, tread and bottom rail shall not allow passage of a sphere 6 inches (152 mm) in diameter.
3. At elevated walking surfaces for access to and use of electrical, mechanical or plumbing systems or equipment, guards shall not have openings which allow passage of a sphere 21 inches (533 mm) in diameter.
4. In areas that are not open to the public within occupancies in Group I-3, F, H or S, and for alternating tread devices and ship ladders, guards shall not have openings which allow passage of a sphere 21 inches (533 mm) in diameter.
5. In assembly seating areas, guards at the end of aisles where they terminate at a fascia of boxes, balconies

and galleries shall not have openings which allow passage of a sphere 4 inches in diameter (102 mm) up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, guards shall not have openings which allow passage of a sphere 8 inches (203 mm) in diameter.

6. Within individual dwelling units and sleeping units in Group R-2 and R-3 occupancies, guards on the open sides of stairs shall not have openings which allow passage of a sphere  $4\frac{3}{8}$  (111 mm) inches in diameter.

7. *Lifeguard towers not open to the public, guards shall not have openings which allow passage of a sphere 21 inches (533 mm) in diameter.*

**1013.5 Screen porches.** Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

**1013.6 Mechanical equipment.** Guards shall be provided where appliances, equipment, fans, roof hatch openings or other components that require service are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter. The guard shall extend not less than 30 inches (762 mm) beyond each end of such appliance, equipment, fan or component.

**1013.7 Roof access.** Guards shall be provided where the roof hatch opening is located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

**1013.8 Window sills.** In Occupancy Groups R-2 and R-3, one- and two-family and multiple-family dwellings, where the opening of the sill portion of an operable window is located more than 72 inches (1829 mm) above the finished grade or other surface below, the lowest part of the clear opening of the window shall be at a height not less than 36 inches (915 mm) above the finished floor surface of the room in which the window is located. Operable sections of windows shall not permit openings that allow passage of a 4-inch-diameter (102 mm) sphere where such openings are located within 36 inches (915 mm) of the finished floor.

**Exceptions:**

1. Operable windows where the sill portion of the opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below and that are provided with window fall prevention devices that comply with ASTM F 2006.
2. Windows whose openings will not allow a 4-inch-diameter (102 mm) sphere to pass through the opening when the window is in its largest opened position.

3. Openings that are provided with window fall prevention devices that comply with ASTM F 2090.
4. Windows that are provided with window opening control devices that comply with Section 1013.8.1.

**1013.8.1 Window opening control devices.** Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1029.2.

## SECTION 1014 EXIT ACCESS

**1014.1 General.** The exit access shall comply with the applicable provisions of Sections 1003 through 1013. Exit access arrangement shall comply with Sections 1014 through 1019.

**1014.2 Egress through intervening spaces.** Egress through intervening spaces shall comply with this section.

1. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas and the area served are accessory to one or the other, are not a Group H occupancy and provide a discernible path of egress travel to an exit.

**Exception:** Means of egress are not prohibited through adjoining or intervening rooms or spaces in a Group H, S or F occupancy when the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.

2. An exit access shall not pass through a room that can be locked to prevent egress.
3. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms.
4. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes.

### Exceptions:

1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit.
2. Means of egress are not prohibited through stockrooms in Group M occupancies when all of the following are met:
  - 2.1. The stock is of the same hazard classification as that found in the main retail area;
  - 2.2. Not more than 50 percent of the exit access is through the stockroom;
  - 2.3. The stockroom is not subject to locking from the egress side; and
  - 2.4. There is a demarcated, minimum 44-inch-wide (1118 mm) aisle defined by

full- or partial-height fixed walls or similar construction that will maintain the required width and lead directly from the retail area to the exit without obstructions.

5. Exits shall not pass through any room subject to locking except in Group I-3 occupancies classified as detention facilities.

**1014.2.1 Multiple tenants.** Where more than one tenant occupies any one floor of a building or structure, each tenant space, dwelling unit and sleeping unit shall be provided with access to the required exits without passing through adjacent tenant spaces, dwelling units and sleeping units.

**Exception:** The means of egress from a smaller tenant space shall not be prohibited from passing through a larger adjoining tenant space where such rooms or spaces of the smaller tenant occupy less than 10 percent of the area of the larger tenant space through which they pass; are the same or similar occupancy group; a discernable path of egress travel to an exit is provided; and the means of egress into the adjoining space is not subject to locking from the egress side. A required means of egress serving the larger tenant space shall not pass through the smaller tenant space or spaces.

**1014.2.2 Basement exits in Group I-2 occupancies.** For additional requirements for occupancies in Group I-2, see Sections 407 of the California Building Code.

**1014.3 Common path of egress travel.** The common path of egress travel shall not exceed the common path of egress travel distances in Table 1014.3.

**TABLE 1014.3  
COMMON PATH OF EGRESS TRAVEL**

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)		WITH SPRINKLER SYSTEM (feet)
	Occupant Load		
	≤ 30	> 30	
B, S <sup>d</sup>	100	75	100 <sup>a</sup>
U	100	75	75 <sup>a</sup>
F	75	75	100 <sup>a</sup>
H-1, H-2, H-3	Not Permitted	Not Permitted	2 <sup>a</sup>
R-2	75	75	125 <sup>b</sup>
R-3 <sup>c</sup>	75	75	125 <sup>b</sup>
I-3	100	100	100 <sup>a</sup>
All others <sup>c, f</sup>	75	75	75 <sup>a</sup>

For SI: 1 foot = 304.8 mm.

- a. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.
- c. For a room or space used for assembly purposes having fixed seating, see Section 1028.8.
- d. The length of a common path of egress travel in a Group S-2 open parking garage shall not be more than 100 feet (30 480 mm).
- e. The length of a common path of egress travel in a Group R-3 occupancy located in a mixed occupancy building.
- f. For the distance limitations in Group I-2, see Section 407.4.

## SECTION 1015 EXIT AND EXIT ACCESS DOORWAYS

**1015.1 Exits or exit access doorways from spaces.** Two exits or exit access doorways from any space shall be provided where one of the following conditions exists:

1. The occupant load of the space exceeds one of the values in Table 1015.1.

### Exceptions:

1. In Group R-2 and R-3 occupancies, one means of egress is permitted within and from individual dwelling units with a maximum occupant load of 20 where the dwelling unit is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Care suites in Group I-2 occupancies complying with Section 407.4.3.
2. The common path of egress travel exceeds one of the limitations of Section 1014.3.
3. Where required by Section 1015.3, 1015.4, 1015.5, or 1015.6.
4. *In detention and correctional facilities and holding cells, such as are found in courthouse buildings, when the occupant load is more than 20 see Section 408.3.11.*

Where a building contains mixed occupancies, each individual occupancy shall comply with the applicable requirements for that occupancy. Where applicable, cumulative occupant loads from adjacent occupancies shall be considered in accordance with the provisions of Section 1004.1.

**TABLE 1015.1  
SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY**

OCCUPANCY	MAXIMUM OCCUPANT LOAD
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-2.1, I-3, I-4, R	10
S	29
L	See Section 443.6.1

a. *For holding cells, see Section 408.3.11.*

### 1015.1.1 Three or more exits or exit access doorways.

Three exits or exit access doorways shall be provided from any space with an occupant load of 501 to 1,000. Four exits or exit access doorways shall be provided from any space with an occupant load greater than 1,000.

**1015.2 Exit or exit access doorway arrangement.** Required exits shall be located in a manner that makes their availability obvious. Exits shall be unobstructed at all times. Exit and exit access doorways shall be arranged in accordance with Sections 1015.2.1 and 1015.2.2. *Exit access doorways, contributing to the total number of exits or exit access doorways required by Sections 1015.1 and 1015.1.1, shall lead to separate exits.*

**1015.2.1 Two exits or exit access doorways.** Where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access door-

ways shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways. Interlocking or scissor stairs shall be counted as one exit stairway.

### Exceptions:

- 1 Where interior exit stairways are interconnected by a 1-hour fire-resistance-rated corridor conforming to the requirements of Section 1018, the required exit separation shall be measured along the shortest direct line of travel within the corridor.
2. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served.

### 1015.2.2 Three or more exits or exit access doorways.

Where access to three or more exits is required, at least two exit doors or exit access doorways shall be arranged in accordance with the provisions of Section 1015.2.1. *Additional required exit or exit access doorways shall be arranged a reasonable distance apart so that if one becomes, blocked, the others will be available.*

**1015.3 Boiler, incinerator and furnace rooms.** Two exit access doorways are required in boiler, incinerator and furnace rooms where the area is over 500 square feet (46 m<sup>2</sup>) and any fuel-fired equipment exceeds 400,000 British thermal units (Btu) (422 000 KJ) input capacity. Where two exit access doorways are required, one is permitted to be a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the length of the maximum overall diagonal dimension of the room.

**1015.4 Refrigeration machinery rooms.** Machinery rooms larger than 1,000 square feet (93 m<sup>2</sup>) shall have not less than two exits or exit access doorways. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of room.

All portions of machinery rooms shall be within 150 feet (45 720 mm) of an exit or exit access doorway. An increase in travel distance is permitted in accordance with Section 1016.1.

Doors shall swing in the direction of egress travel, regardless of the occupant load served. Doors shall be tight fitting and self-closing.

**1015.5 Refrigerated rooms or spaces.** Rooms or spaces having a floor area larger than 1,000 square feet (93 m<sup>2</sup>), containing a refrigerant evaporator and maintained at a temperature below 68°F (20°C), shall have access to not less than two exits or exit access doorways.

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Travel distance shall be determined as specified in Section 1016.1, but all portions of a refrigerated room or space shall be within 150 feet (45 720 mm) of an exit or exit access doorway where such rooms are not protected by an approved automatic sprinkler system. Egress is allowed through adjoining refrigerated rooms or spaces.

**Exception:** Where using refrigerants in quantities limited to the amounts based on the volume set forth in the *California Mechanical Code*.

**1015.6 Day care means of egress.** Day care facilities, rooms or spaces where care is provided for more than 10 children that are 2 years of age or less, shall have access to not less than two exits or exit access doorways.

**1015.7 Large family day-care home.** Every story or basement of a large family day-care home shall be provided with two exits which are remotely located from each other. Every required exit shall be of a size to permit the installation of a door not less than 32 inches (813 mm) in clear width and not less than 6 feet 8 inches (2,032 mm) in height. A manually operated horizontal sliding door may be used as one of the two required exits.

Where basements are used for day-care purposes, one of the two required exits shall provide access directly to the exterior without entering the first story. The second exit from the basement may either pass through the story above or exit directly to the exterior.

Rooms used for day-care purposes shall not be located above the first story.

**Exception:** Buildings equipped with an automatic sprinkler system throughout and which have at least one of the required exits providing access directly to the exterior. NFPA 13R may be used in large family day-care homes. The sprinkler omissions of NFPA 13R shall not apply unless approved by the enforcing agency.

Exit doors, including manually operated horizontal sliding doors, shall be openable from the inside without use of a key or any special knowledge or effort.

Tables 1021.1 and 1021.2 are not applicable to this occupancy classification.

### SECTION 1016 EXIT ACCESS TRAVEL DISTANCE

**1016.1 General.** Travel distance within the exit access portion of the means of egress system shall be in accordance with this section.

**1016.2 Limitations.** Exit access travel distance shall not exceed the values given in Table 1016.2.

**1016.2.1 Exterior egress balcony increase.** Exit access travel distances specified in Table 1016.2 shall be increased up to an additional 100 feet (30 480 mm) provided the last portion of the exit access leading to the exit occurs on an exterior egress balcony constructed in accordance with Section 1019. The length of such balcony shall not be less than the amount of the increase taken.

**TABLE 1016.2  
EXIT ACCESS TRAVEL DISTANCE<sup>a</sup>**

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200	250 <sup>b</sup>
R-2.1	Not Permitted	250 <sup>c</sup>
B	200	300 <sup>c</sup>
F-2, S-2, U	300	400 <sup>c</sup>
H-1	Not Permitted	75 <sup>c</sup>
H-2	Not Permitted	100 <sup>c</sup>
H-3	Not Permitted	150 <sup>c</sup>
H-4	Not Permitted	175 <sup>c</sup>
H-5	Not Permitted	200 <sup>c</sup>
I-2, I-2.1, I-3 <sup>d</sup> , I-4	Not Permitted	200 <sup>c</sup>
L	Not Permitted	200 <sup>c</sup>

For SI: 1 foot = 304.8 mm.

a. See the following sections for modifications to exit access travel distance requirements:

Section 402.8: For the distance limitation in malls.

Section 404.9: For the distance limitation through an atrium space.

Section 407.4: For the distance limitation in Group I-2.

Section 408.3.10: For increased limitation in Group I-3.

Sections 408.6.1 and 408.8.1: For the distance limitations in Group I-3.

Section 411.4: For the distance limitation in special amusement buildings.

Section 1015.4: For the distance limitation in refrigeration machinery rooms.

Section 1015.5: For the distance limitation in refrigerated rooms and spaces.

Section 1016.2.2: For increased limitation in Groups F-1 and S-1.

Section 1021.2: For buildings with one exit.

Section 1028.7: For increased limitation in assembly seating.

Section 1028.7: For increased limitation for assembly open-air seating.

Section 3103.4: For temporary structures.

Section 3104.9: For pedestrian walkways.

b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.

c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

d. Not permitted in nonsprinklered Group I-3 Occupancies.

dance with Section 1019. The length of such balcony shall not be less than the amount of the increase taken.

**1016.2.2 Group F-1 and S-1 increase.** The maximum exit access travel distance shall be 400 feet (122 m) in Group F-1 or S-1 occupancies where all of the following are met:

1. The portion of the building classified as Group F-1 or S-1 is limited to one story in height,
2. The minimum height from the finished floor to the bottom of the ceiling or roof slab or deck is 24 feet (7315 mm), and
3. The building is equipped throughout with an automatic fire sprinkler system in accordance with Section 903.3.1.1.

**1016.3 Measurement.** Exit access travel distance shall be measured from the most remote point within a story along the natural and unobstructed path of horizontal and vertical egress travel to the entrance to an exit.

**Exceptions:**

1. In open parking garages, exit access travel distance is permitted to be measured to the closest riser of an exit access stairway or the closest slope of an exit access ramp.
2. In outdoor facilities with open exit access components, exit access travel distance is permitted to be measured to the closest riser of an exit access stairway or the closest slope of an exit access ramp.

**1016.3.1 Exit access stairways and ramps.** Travel distance on exit access stairways or ramps shall be included in the exit access travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stair and landings. The measurement along ramps shall be made on the walking surface in the center of the ramp and landings.

## SECTION 1017 AISLES

*[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 11B-403, as applicable.*

**1017.1 General.** Aisles and aisle accessways serving as a portion of the exit access in the means of egress system shall comply with the requirements of this section. Aisles or aisle accessways shall be provided from all occupied portions of the exit access which contain seats, tables, furnishings, displays and similar fixtures or equipment. The required width of aisles shall be unobstructed.

**Exception:** Encroachments complying with Section 1005.7.

**1017.2 Aisles in assembly spaces.** Aisles and aisle accessways serving a room or space used for assembly purposes shall comply with Section 1028.

**1017.3 Aisles in Groups B and M.** In Group B and M occupancies, the minimum clear aisle width shall be determined by Section 1005.1 for the occupant load served, but shall not be less than 36 inches (914 mm).

**Exception:** Nonpublic aisles serving less than 50 people and not required to be accessible by Chapter 11B, (see Section 11B-403) need not exceed 28 inches (711 mm) in width.

**1017.4 Aisle accessways in Group M.** An aisle accessway shall be provided on at least one side of each element within

the merchandise pad. The minimum clear width for an aisle accessway not required to be accessible shall be 30 inches (762 mm). The required clear width of the aisle accessway shall be measured perpendicular to the elements and merchandise within the merchandise pad. The 30-inch (762 mm) minimum clear width shall be maintained to provide a path to an adjacent aisle or aisle accessway. The common path of egress travel shall not exceed 30 feet (9144 mm) from any point in the merchandise pad.

**Exception:** For areas serving not more than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm).

**1017.5 Aisles in other than assembly spaces and Groups B and M.** In other than rooms or spaces used for assembly purposes and Group B and M occupancies, the minimum clear aisle width shall be determined by Section 1005.1 for the occupant load served, but shall not be less than 36 inches (914 mm).

## SECTION 1018 CORRIDORS

**1018.1 Construction.** Corridors shall be fire-resistance rated in accordance with Table 1018.1. The corridor walls required to be fire-resistance rated shall comply with Section 708 for fire partitions.

**Exceptions:**

1. A fire-resistance rating is not required for corridors in an occupancy in Group E where each room that is used for instruction has at least one door opening directly to the exterior and rooms for assembly purposes have at least one-half of the required means of egress doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.
2. A fire-resistance rating is not required for corridors contained within a dwelling or sleeping unit in an occupancy in Group R.
3. A fire-resistance rating is not required for corridors in open parking garages.
4. A fire-resistance rating is not required for corridors in an occupancy in Group B which is a space requiring only a single means of egress complying with Section 1015.1.
5. Corridors adjacent to the exterior walls of buildings shall be permitted to have unprotected openings on unrated exterior walls where unrated walls are permitted by Table 602 and unprotected openings are permitted by Table 705.8.
6. A fire-resistance rating is not required for corridors within suites in a Group I-2 occupancy provided with an automatic sprinkler system throughout and constructed in accordance with Section 407.4.3.5 or 407.4.3.6.

**TABLE 1018.1**  
**CORRIDOR FIRE-RESISTANCE RATING**

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system <sup>c</sup>
H-1, H-2, H-3, <i>L</i>	All	Not Permitted	1
H-4, H-5, <i>L</i>	Greater than 30	Not Permitted	1
A <sup>d</sup> , B, E, F, M, S, U	Greater than 30	1	0
R-1, R-2, R-3, R-3.1, R-4	Greater than 10	Not Permitted	1
I-2 <sup>a</sup> , I-2.1, I-4	Greater than 6	Not Permitted	1
I-3, R-2.1	Greater than 6	Not Permitted	1 <sup>b</sup>
<i>E</i>	Greater than 10	1	1

a. For requirements for occupancies in Group I-2, see Sections 407.2 and 407.3.

b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Sections 408.1.2 and 408.8.

c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.

d. [SFM] See Section 1028.

**1018.2 Width.** The minimum width of corridors specified in Table 1018.2 shall be as determined in Section 1005.1.

**TABLE 1018.2**  
**MINIMUM CORRIDOR WIDTH**

OCCUPANCY	WIDTH (minimum)
Any facilities not listed below	44 inches
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24 inches
With a required occupancy capacity less than 50	36 inches
Within a dwelling unit	36 inches
In Group E with a corridor having a required capacity of 100 or more	72 inches
In corridors and areas serving gurney traffic in occupancies where patients receive outpatient medical care, which causes the patient to be incapable of self-preservation	72 inches
Group I-2 in areas where required for bed movement	96 inches
Corridors in Group I-2 and I-3 occupancies serving any area caring for one or more nonambulatory persons.	96 inches

For SI: 1 inch = 25.4 mm.

**1018.3 Obstruction.** The required width of corridors shall be unobstructed.

**Exception:** Encroachments complying with Section 1005.7.

**1018.4 Dead ends.** Where more than one exit or exit access doorway is required, the exit access shall be arranged such that there are no dead ends in corridors more than 20 feet (6096 mm) in length.

#### Exceptions:

1. In occupancies in Group I-3 of Occupancy Condition 2, 3 or 4 (see Section 308.5), the dead end in a corridor shall not exceed 50 feet (15 240 mm).

2. In occupancies in Groups B, E, F, I-1, M, R-1, R-2, R-4, S and U, where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of the dead-end corridors shall not exceed 50 feet (15 240 mm).

3. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.

**1018.5 Air movement in corridors.** Corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts.

#### Exceptions:

1. Use of a corridor as a source of makeup air for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, and janitor closets, shall be permitted, provided that each such corridor is directly supplied with outdoor air at a rate greater than the rate of makeup air taken from the corridor.
2. Where located within a dwelling unit, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m<sup>2</sup>) or less in area, utilization of corridors for conveying return air is permitted.
4. Incidental air movement from pressurized rooms within health care facilities, provided that the corridor is not the primary source of supply or return to the room.
5. For health care facilities under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD), see the California Mechanical Code.

**1018.5.1 Corridor ceiling.** Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction;
2. The corridor is separated from the plenum by fire-resistance-rated construction;
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by the California Mechanical Code;
4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow where the building is equipped throughout with an automatic sprinkler system; or
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an approved engineered smoke control system.



**1018.6 Corridor continuity.** Fire-resistance-rated corridors shall be continuous from the point of entry to an exit, and shall not be interrupted by intervening rooms. Where the path of egress travel within a fire-resistance-rated corridor to the exit includes travel along unenclosed exit access stairways or ramps, the fire resistance-rating shall be continuous for the length of the stairway or ramp and for the length of the connecting corridor on the adjacent floor leading to the exit.

**Exceptions:**

1. Foyers, lobbies or reception rooms constructed as required for corridors shall not be construed as intervening rooms.
2. *[SFM] In fully sprinklered office buildings, corridors may lead through enclosed elevator lobbies if all areas of the building have access to at least one required exit without passing through the elevator lobby.*

## SECTION 1019 EGRESS BALCONIES

**1019.1 General.** Balconies used for egress purposes shall conform to the same requirements as corridors for width, headroom, dead ends and projections.

**1019.2 Wall separation.** Exterior egress balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors.

**Exception:** Separation is not required where the exterior egress balcony is served by at least two stairs and a dead-end travel condition does not require travel past an unprotected opening to reach a stair.

**1019.3 Openness.** The long side of an egress balcony shall be at least 50 percent open, and the open area above the guards shall be so distributed as to minimize the accumulation of smoke or toxic gases.

**1019.4 Location.** Exterior egress balconies shall have a minimum fire separation distance of 10 feet (3048 mm) measured from the exterior edge of the egress balcony to adjacent lot lines and from other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 705 based on fire separation distance.

## SECTION 1020 EXITS

**1020.1 General.** Exits shall comply with Sections 1020 through 1026 and the applicable requirements of Sections 1003 through 1013. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge.

**1020.2 Exterior exit doors.** Buildings or structures used for human occupancy shall have at least one exterior door that meets the requirements of Section 1008.1.1.

**1020.2.1 Detailed requirements.** Exterior exit doors shall comply with the applicable requirements of Section 1008.1.

**1020.2.2 Arrangement.** Exterior exit doors shall lead directly to the exit discharge or the public way.

## SECTION 1021 NUMBER OF EXITS

**1021.1 General.** Each story and occupied roof shall have the minimum number of *independent* exits, or access to exits, as specified in *Table 1021.1*. A *single exit or access to a single exit shall be permitted in accordance with Section 1021.2*. The required number of exits, or exit access stairways or ramps providing access to exits, from any story shall be maintained until arrival at grade or a public way.

**1021.2 Single Exits.** A *single exit or access to a single exit shall be permitted* from any story or occupied roof, provided one of the following conditions exists:

1. The occupant load, number of dwelling units *and exit access travel distance does not exceeds* the values in *Table 1021.2(1) or 1021.2(2)*.
2. Rooms, areas and spaces complying with Section 1015.1 with exits that discharge directly to the exterior at the level of exit discharge, are permitted to have one *exit or access to a single exit*.
3. Group R-3 occupancy buildings shall be permitted to have one exit *where each individual story complies with Table 1021.2(1)*.
4. Parking garages where vehicles are mechanically parked shall be permitted to have one exit. *or access to a single exit*.
5. Group R-3 and R-4 congregate residences shall be permitted to have one exit *where each individual story complies with Table 1021.2(1)*.
6. *Individual single-story or multistory dwelling units shall be permitted to have a single exit or access to a single exit from the dwelling unit provided that all of the following criteria are met:*
  - 6.1. *The dwelling unit complies with Section 1015.1 as a space with one means of egress and*
  - 6.2. *Either the exit from the dwelling unit discharges directly to the exterior at the level of exit discharge, or the exit access outside the dwelling unit's entrance door provides access to not less than two approved independent exits.*

**1021.2.1 Mixed occupancies.** Where one exit, or exit access stairway or ramp providing access to exits at other stories, is permitted to serve individual stories, mixed occupancies shall be permitted to be served by single exits provided each individual occupancy complies with the applicable requirements of *Table 1021.2(1) or Table 1021.2(2)* for that occupancy. Where applicable, cumulative occupant loads from adjacent occupancies shall be considered in accordance with the provisions of Section 1004.1.

In each story of a mixed occupancy building, the maximum number of occupants served by a single exit shall be such that the sum of the ratios of the calculated number of occupants of the space divided by the allowable number of occupants indicated in Table 1012.3(1) for each occupancy does not exceed one. Where dwelling units are located on a story with other occupancies, the actual number of dwelling units divided by four plus the ratio from the other occupancy does not exceed one.

**1021.2.2 Exits from specific space.** Exits serving specific spaces or areas need not be accessed by the remainder of the story when all of the following are met:

1. The number of exits from the entire story complies with Section 1021.1 and 1021.4.1;
2. The access to exits from each individual space in the story complies with Section 1015.1; and
3. All spaces within each portion of a story shall have access to the minimum number of approved independent exits based on the occupant load of that portion of the story but not less than two exits.

➤ **1021.3 Vehicular ramps.** Vehicular ramps shall not be considered as an exit access ramp unless pedestrian facilities are provided.

**TABLE 1021.1  
MINIMUM NUMBER OF EXITS  
OR ACCESS TO EXITS PER STORY**

OCCUPANT LOAD PER STORY	MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS FROM STORY
1-500	2
501-1,000	3
More than 1,000	4

## SECTION 1022 INTERIOR EXIT STAIRWAYS AND RAMPS

**1022.1 General.** Interior exit stairways and interior exit ramps serving as an exit component in a means of egress system shall comply with the requirements of this section. Interior exit stairways and ramps shall lead directly to the exterior of the building or shall be extended to the exterior of the building with an exit passageway conforming to the requirements of Section 1023, except as permitted in Section 1027.1. An interior exit stairway or ramp shall not be used for any purpose other than as a means of egress.

**1022.2 Construction.** Enclosures for interior exit stairways and ramps shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Interior exit stairway and ramp enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more and not less than 1 hour where connecting less than four stories. The number of stories connected by the interior exit stairways or ramps shall include any basements, but not any mezzanines. Interior exit stairways and ramps shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.

### Exceptions:

1. Interior exit stairways and ramps in Group I-3 occupancies in accordance with the provisions of Section 408.3.8.
2. Fixed guideway transit stations, constructed in accordance with Section 433.

**1022.3 Termination.** Interior exit stairways and ramps shall terminate at an exit discharge or a public way.

**Exception:** Interior exit stairways and ramps shall be permitted to terminate at an exit passageway complying with Section 1023, provided the exit passageway terminates at an exit discharge or a public way.

**1022.3.1 Extension.** Where interior exit stairways and ramps are extended to an exit discharge or a public way by an exit passageway, the interior exit stairway and ramp shall be separated from the exit passageway by a fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both. The fire-resistance rating shall be at least equal to that required for the interior exit stairway and ramp. A fire door assembly complying with Section 716.5 shall be installed in the fire barrier to provide a means of egress from the interior exit stairway and ramp to the exit passageway. Openings in the fire barrier other than the fire door assembly are prohibited. Penetrations of the fire barrier are prohibited.

**Exception:** Penetrations of the fire barrier in accordance with Section 1022.5 shall be permitted.

**1022.4 Openings.** Interior exit stairway and ramp opening protectives shall be in accordance with the requirements of Section 716.

Openings in interior exit stairways and ramps other than unprotected exterior openings shall be limited to those necessary for exit access to the enclosure from normally occupied spaces and for egress from the enclosure.

Elevators shall not open into interior exit stairways and ramps.

**1022.5 Penetrations.** Penetrations into and openings through interior exit stairways and ramps are prohibited except for required exit doors, equipment and ductwork necessary for independent ventilation or pressurization, sprinkler piping, standpipes, electrical raceway for fire department communication systems and electrical raceway serving the interior exit stairway and ramp and terminating at a steel box not exceeding 16 square inches (0.010 m<sup>2</sup>). Such penetrations shall be protected in accordance with Section 714. There shall be no penetrations or communicating openings, whether protected or not, between adjacent interior exit stairways and ramps.

**Exception:** Membrane penetrations shall be permitted on the outside of the interior exit stairway and ramp. Such penetrations shall be protected in accordance with Section 714.3.2.

**TABLE 1021.2(1) (IFC [B] TABLE 1021.2(1))**  
**STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2, R-3 AND R-4 OCCUPANCIES**

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM EXIT ACCESS TRAVEL DISTANCE
Basement, first, second or third story <i>above grade plane</i>	R-2 <sup>a, b</sup> , R-3 <sup>a</sup> , R-4	4 dwelling units NA	125 feet NA
Fourth story <i>above grade plane</i> and <i>higher above</i>	R-3 <sup>a</sup> , R-4	NA	125 feet

For SI: 1 foot = 304.8 mm.

NP – Not Permitted

NA – Not Applicable

a. Buildings classified as Group R-2 or R-3 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1029.

b. This table is used for R-2 occupancies consisting of dwelling units. For R-2 occupancies consisting of sleeping units, use Table 1021.2(2).

**TABLE 1021.2(2)**  
**STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES**

STORY	OCCUPANCY	MAXIMUM OCCUPANTS PER STORY	MAXIMUM EXIT ACCESS TRAVEL DISTANCE
First story <i>above or below grade plane</i> basement	A, B <sup>b</sup> , E, F <sup>b</sup> , M, U, S <sup>b</sup>	49 occupants	75 feet
	H-2, H-3	3 occupants	25 feet
	H-4, H-5, I, R-1, R-2 <sup>a, c</sup> , R-4	10 occupants	75 feet
	I-2, I-2.1	29 occupants	100 feet
	S	7 occupants	50 feet
Second story <i>above grade plane</i>	B, F, M, S	29 occupants	75 feet
Third story <i>above grade plane</i> and <i>above higher</i>	NP	NA	NA

For SI: 1 foot = 304.8 mm.

NP – Not Permitted

NA – Not Applicable

a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1029.

b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall have a maximum travel distance of 100 feet.

c. This table is used for R-2 occupancies consisting of sleeping units. For R-2 occupancies consisting of dwelling units, use Table 1021.2(1).

**1022.6 Ventilation.** Equipment and ductwork for interior exit stairway and ramp ventilation as permitted by Section 1022.5 shall comply with one of the following items:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the interior exit stairway and ramp by ductwork enclosed in construction as required for shafts.
2. Where such equipment and ductwork is located within the interior exit stairway and ramp, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and

operation and shall be protected by opening protectives in accordance with Section 716 for shaft enclosures.

The interior exit stairway and ramp ventilation systems shall be independent of other building ventilation systems.

**1022.7 Interior exit stairway and ramp exterior walls.** Exterior walls of the interior exit stairway and ramp shall comply with the requirements of Section 705 for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than  $\frac{3}{4}$  hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the topmost landing of the stairway or to the roof line, whichever is lower.

**1022.8 Discharge identification.** An interior exit stairway and ramp shall not continue below its level of exit discharge unless an approved barrier is provided at the level of exit discharge to prevent persons from unintentionally continuing into levels below. Directional exit signs shall be provided as specified in Section 1011.

**1022.9 Stairway identification signs.** A sign shall be provided at each floor landing in an interior exit stairway and ramp connecting more than three stories designating the floor level, the terminus of the top and bottom of the interior exit stairway and ramp and the identification of the stair or ramp. The signage shall also state the story of, and the direction to, the exit discharge and the availability of roof access from the interior exit stairway and ramp for the fire department. The sign shall be located 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions.

*In addition to the stairway identification sign, raised characters and braille floor identification signs that comply with Chapter 11A, Section 1143A or Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5 shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters.*

**1022.9.1 Signage requirements.** Stairway identification signs shall comply with all of the following requirements:

1. The signs shall be a minimum size of 18 inches (457 mm) by 12 inches (305 mm).
2. The letters designating the identification of the stair enclosure, *such as STAIR NO. 1 or WEST STAIR*, shall be placed at the top of the sign and shall be a minimum of  $1\frac{1}{2}$  inches (38 mm) in height block lettering with  $\frac{1}{4}$ -inch (6 mm) strokes.
3. The number designating the floor level shall be a minimum of 5 inches (127 mm) in height with  $\frac{3}{4}$ -inch (19 mm) strokes and located in the center of the sign. The mezzanine levels shall have the letter "M" preceding the floor level. Basement levels shall have the letter "B" preceding the floor number.
4. All other lettering and numbers shall be a minimum of 1 inch (25 mm) in height.
5. The stairway's upper terminus, *such as ROOF ACCESS or NO ROOF ACCESS*, shall be placed under the stairway identification in 1-inch-high (25 mm) block lettering with  $\frac{1}{4}$ -inch (6 mm) strokes.
6. The lower and upper terminus of the stairway shall be placed at the bottom of the sign in 1-inch-high (25 mm) block lettering with  $\frac{1}{4}$ -inch (6 mm) strokes.
7. Characters and their background shall have a non-glare finish. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.

8. When signs required by Section 1022.9 are installed in interior exit stairways and ramps of buildings subject to Section 1024, the signs shall be made of the same materials as required by Section 1024.4.

**1022.10 Smokeproof enclosures.** Where required by Section 403.5.4 or 405.7.2, interior exit stairways and ramps shall be smokeproof enclosures in accordance with Section 909.20.

**1022.10.1 Termination and extension.** A smokeproof enclosure shall terminate at an exit discharge or a public way. The smokeproof enclosure shall be permitted to be extended by an exit passageway in accordance with Section 1022.3. The exit passageway shall be without openings other than the fire door assembly required by Section 1022.3.1 and those necessary for egress from the exit passageway. The exit passageway shall be separated from the remainder of the building by 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. Openings in the exit passageway serving a smokeproof enclosure are permitted where the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure, and openings are protected as required for access from other floors.
2. The fire barrier separating the smokeproof enclosure from the exit passageway is not required, provided the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure.
3. A smokeproof enclosure shall be permitted to egress through areas on the level of exit discharge or vestibules as permitted by Section 1027.

**1022.10.2 Enclosure access.** Access to the stairway within a smokeproof enclosure shall be by way of a vestibule or an open exterior balcony.

## SECTION 1023 EXIT PASSAGEWAYS

**1023.1 Exit passageway.** Exit passageways serving as an exit component in a means of egress system shall comply with the requirements of this section. An exit passageway shall not be used for any purpose other than as a means of egress.

**1023.2 Width.** The minimum width of exit passageways shall be determined as specified in Section 1005.1 but such width shall not be less than 44 inches (1118 mm), except that exit passageways serving an occupant load of less than 50 shall not be less than 36 inches (914 mm) in width. The required width of exit passageways shall be unobstructed.

**Exceptions:**

1. Encroachment complying with Section 1005.7.
2. Doors complying with Section 1005.2.

*The clear width of exit passageways in a Group I-2 occupancy used for the movement of beds and litters shall be 44-inch (1118) minimum.*

**1023.3 Construction.** Exit passageway enclosures shall have walls, floors and ceilings of not less than a 1-hour fire-resistance rating, and not less than that required for any connecting interior exit stairway or ramp. Exit passageways shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**1023.4 Termination.** Exit passageways on the level of exit discharge shall terminate at an exit discharge. Exit passageways on other levels shall terminate at an exit.

**1023.5 Openings and penetrations.** Exit passageway opening protectives shall be in accordance with the requirements of Section 716.

Except as permitted in Section 402.8.7, openings in exit passageways other than exterior openings shall be limited to those necessary for exit access to the exit passageway from normally occupied spaces and for egress from the exit passageway.

Where an interior exit stairway or ramp is extended to an exit discharge or a public way by an exit passageway, the exit passageway shall also comply with Section 1022.3.1.

Elevators shall not open into an exit passageway.

**1023.6 Penetrations.** Penetrations into and openings through an exit passageway are prohibited except for required exit doors, equipment and ductwork necessary for independent pressurization, sprinkler piping, standpipes, electrical raceway for fire department communication and electrical raceway serving the exit passageway and terminating at a steel box not exceeding 16 square inches (0.010m<sup>2</sup>). Such penetrations shall be protected in accordance with Section 714. There shall be no penetrations or communicating openings, whether protected or not, between adjacent exit passageways.

**Exception:** Membrane penetrations shall be permitted on the outside of the exit passageway. Such penetrations shall be protected in accordance with Section 714.3.2.

## SECTION 1024 LUMINOUS EGRESS PATH MARKINGS

**1024.1 General.** Approved luminous egress path markings delineating the exit path shall be provided in high-rise buildings of Group A, B, E, I, M, and R-1 occupancies in accordance with Sections 1024.1 through 1024.5.

**Exception:** Luminous egress path markings shall not be required on the level of exit discharge in lobbies that serve as part of the exit path in accordance with Section 1027.1, Exception 1.

**1024.2 Markings within exit components.** Egress path markings shall be provided in interior exit stairways, interior exit ramps and exit passageways, in accordance with Sections 1024.2.1 through 1024.2.6.

**1024.2.1 Steps.** A solid and continuous stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining

stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed at a maximum of 1/2 inch (13 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than 1/2 inch (13 mm) down the vertical face of the step.

**Exception:** The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

**1024.2.2 Landings.** The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

**1024.2.3 Handrails.** All handrails and handrail extensions shall be marked with a solid and continuous stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

**Exception:** The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

**1024.2.4 Perimeter demarcation lines.** Stair landings and other floor areas within interior exit stairways, interior exit ramps and exit passageways, with the exception of the sides of steps, shall be provided with solid and continuous demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 to 2 inches (25 mm to 51 mm) wide with interruptions not exceeding 4 inches (102 mm).

**Exception:** The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

**1024.2.4.1 Floor mounted demarcation lines.** Perimeter demarcation lines shall be placed within 4 inches (102 mm) of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

**Exception:** Demarcation lines shall not extend in front of exit discharge doors that lead out of an exit and through which occupants must travel to complete the exit path.

**1024.2.4.2 Wall mounted demarcation lines.** Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe no more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door,

demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such door.

**Exception:** Demarcation lines shall not extend in front of exit discharge doors that lead out of an exit and through which occupants must travel to complete the exit path.

**1024.2.4.3 Transition.** Where a wall mounted demarcation line transitions to a floor mounted demarcation line, or vice-versa, the wall mounted demarcation line shall drop vertically to the floor to meet a complementary extension of the floor mounted demarcation line, thus forming a continuous marking.

**1024.2.5 Obstacles.** Obstacles at or below 6 feet 6 inches (1981 mm) in height and projecting more than 4 inches (102 mm) into the egress path shall be outlined with markings no less than 1 inch (25 mm) in width comprised of a pattern of alternating equal bands, of luminescent luminous material and black, with the alternating bands no more than 2 inches (51 mm) thick and angled at 45 degrees. Obstacles shall include, but are not limited to, standpipes, hose cabinets, wall projections, and restricted height areas. However, such markings shall not conceal any required information or indicators including but not limited to instructions to occupants for the use of standpipes.

**1024.2.6 Doors within the exit path.** Doors through which occupants must pass in order to complete the exit path shall be provided with markings complying with Sections 1024.2.6.1 through 1024.2.6.3.

**1024.2.6.1 Emergency exit symbol.** The doors shall be identified by a low-location luminous emergency exit symbol complying with NFPA 170. The exit symbol shall be a minimum of 4 inches (102 mm) in height and shall be mounted on the door, centered horizontally, with the top of the symbol no higher than 18 inches (457 mm) above the finished floor.

**1024.2.6.2 Door hardware markings.** Door hardware shall be marked with no less than 16 square inches (406 mm<sup>2</sup>) of luminous material. This marking shall be located behind, immediately adjacent to, or on the door handle or escutcheon. Where a panic bar is installed, such material shall be no less than 1 inch (25 mm) wide for the entire length of the actuating bar or touchpad.

**1024.2.6.3 Door frame markings.** The top and sides of the door frame shall be marked with a solid and continuous 1-inch- to 2-inch-wide (25 mm to 51 mm) stripe. Where the door molding does not provide sufficient flat surface on which to locate the stripe, the stripe shall be permitted to be located on the wall surrounding the frame.

**1024.3 Uniformity.** Placement and dimensions of markings shall be consistent and uniform throughout the same enclosure.

**1024.4 Self-luminous and photoluminescent.** Luminous egress path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is

not required to maintain the required luminance. Such materials shall include, but not be limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994; or
2. ASTM E 2072, except that the charging source shall be 1 footcandle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 milicandelas per square meter at 10 minutes and 5 milicandelas per square meter after 90 minutes.

**1024.5 Illumination.** Where photoluminescent exit path markings are installed, they shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60 minutes prior to periods when the building is occupied.

## SECTION 1025 HORIZONTAL EXITS

**1025.1 Horizontal exits.** Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit width shall be horizontal exits.

### Exceptions:

1. Horizontal exits are permitted to comprise two-thirds of the required exits from any building or floor area for occupancies in Group I-2.
2. Horizontal exits are permitted to comprise 100 percent of the exits required for occupancies in Group I-3. At least 6 square feet (0.6 m<sup>2</sup>) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

**1025.2 Separation.** The separation between buildings or refuge areas connected by a horizontal exit shall be provided by a fire wall complying with Section 706; or it shall be provided by a fire barrier complying with Section 707 or a horizontal assembly complying with Section 711, or both. The minimum fire-resistance rating of the separation shall be 2 hours. Opening protectives in horizontal exits shall also comply with Section 716. Duct and air transfer openings in a fire wall or fire barrier that serves as a horizontal exit shall also comply with Section 717. The horizontal exit separation shall extend vertically through all levels of the building unless floor assemblies have a fire-resistance rating of not less than 2 hours with no unprotected openings.

**Exception:** A fire-resistance rating is not required at horizontal exits between a building area and an above-grade pedestrian walkway constructed in accordance with Section 3104, provided that the distance between connected buildings is more than 20 feet (6096 mm).

Horizontal exits constructed as fire barriers shall be continuous from exterior wall to exterior wall so as to divide completely the floor served by the horizontal exit.

**1025.3 Opening protectives.** Fire doors in horizontal exits shall be self-closing or automatic-closing when activated by a smoke detector in accordance with Section 716.5.9.3. Doors, where located in a cross-corridor condition, shall be automatic-closing by activation of a smoke detector installed in accordance with Section 716.5.9.3.

**1025.4 Capacity of refuge area.** The refuge area of a horizontal exit shall be a space occupied by the same tenant or a public area and each such refuge area shall be adequate to accommodate the original occupant load of the refuge area plus the occupant load anticipated from the adjoining compartment. The anticipated occupant load from the adjoining compartment shall be based on the capacity of the horizontal exit doors entering the refuge area. The capacity of the refuge area shall be computed based on a net floor area allowance of 3 square feet (0.2787 m<sup>2</sup>) for each occupant to be accommodated therein.

**Exception:** The net floor area allowable per occupant shall be as follows for the indicated occupancies:

1. Six square feet (0.6 m<sup>2</sup>) per occupant for occupancies in Group I-3.
2. Fifteen square feet (1.4 m<sup>2</sup>) per occupant for ambulatory occupancies in Group I-2.
3. Thirty square feet (2.8 m<sup>2</sup>) per occupant for nonambulatory occupancies in Group I-2.

The refuge area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant load imposed by persons entering it through horizontal exits from other areas. *In other than I-3 occupancies*, at least one refuge area exit shall lead directly to the exterior or to an interior exit stairway or ramp.

**Exception:** The adjoining compartment shall not be required to have a stairway or door leading directly outside, provided the refuge area into which a horizontal exit leads has stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

## SECTION 1026

### EXTERIOR EXIT STAIRWAYS AND RAMPS

**1026.1 Exterior exit stairways and ramps.** Exterior exit stairways and ramps serving as an element of a required means of egress shall comply with this section.

**1026.2 Use in a means of egress.** Exterior exit stairways shall not be used as an element of a required means of egress for Group I-2 occupancies. For occupancies in other than Group I-2, exterior exit stairways and ramps shall be permitted as an element of a required means of egress for buildings not exceeding six stories above grade plane or which are not high-rise buildings.

**1026.3 Open side.** Exterior exit stairways and ramps serving as an element of a required means of egress shall be open on at least one side. An open side shall have a minimum of 35

square feet (3.3 m<sup>2</sup>) of aggregate open area adjacent to each floor level and the level of each intermediate landing. The required open area shall be located not less than 42 inches (1067 mm) above the adjacent floor or landing level.

**1026.4 Side yards.** The open areas adjoining exterior exit stairways or ramps shall be either yards, courts or public ways; the remaining sides are permitted to be enclosed by the exterior walls of the building.

**1026.5 Location.** Exterior exit stairways and ramps shall have a minimum fire separation distance of 10 feet (3048 mm) measured from the exterior edge of the stairway or ramp, including landings, to adjacent lot lines and from other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 705 based on fire separation distance.

**1026.6 Exterior stairway and ramp protection.** Exterior exit stairways and ramps shall be separated from the interior of the building as required in Section 1022.2. Openings shall be limited to those necessary for egress from normally occupied spaces.

#### Exceptions:

1. Separation from the interior of the building is not required for occupancies, other than those in Group R-1 or R-2, in buildings that are no more than two stories above grade plane where a level of exit discharge serving such occupancies is the first story above grade plane.
2. Separation from the interior of the building is not required where the exterior stairway or ramp is served by an exterior ramp or balcony that connects two remote exterior stairways or other approved exits with a perimeter that is not less than 50 percent open. To be considered open, the opening shall be a minimum of 50 percent of the height of the enclosing wall, with the top of the openings no less than 7 feet (2134 mm) above the top of the balcony.
3. Separation from the interior of the building is not required for an exterior stairway or ramp located in a building or structure that is permitted to have unenclosed exit access stairways in accordance with Section 1009.3.
4. Separation from the interior of the building is not required for exterior stairways or ramps connected to open-ended corridors, provided that Items 4.1 through 4.5 are met:
  - 4.1. The building, including corridors, stairways or ramps, shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
  - 4.2. The open-ended corridors comply with Section 1018.
  - 4.3. The open-ended corridors are connected on each end to an exterior exit stairway or ramp complying with Section 1026.

- 4.4. The exterior walls and openings adjacent to the exterior exit stairway or ramp comply with Section 1022.7.
- 4.5. At any location in an open-ended corridor where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3.3 m<sup>2</sup>) or an exterior stairway or ramp shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.

## SECTION 1027 EXIT DISCHARGE

**1027.1 General.** Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide a direct *path of egress travel* to grade. The exit discharge shall not reenter a building. The combined use of Exceptions 1 and 2 shall not exceed 50 percent of the number and capacity of the required exits.

### Exceptions:

1. A maximum of 50 percent of the number and capacity of interior exit stairways and ramps is permitted to egress through areas on the level of exit discharge provided all of the following are met:
  - 1.1. Such enclosures egress to a free and unobstructed path of travel to an exterior exit door and such exit is readily visible and identifiable from the point of termination of the enclosure.
  - 1.2. The entire area of the level of exit discharge is separated from areas below by construction conforming to the fire-resistance rating for the enclosure.
  - 1.3. The egress path from the interior exit stairway and ramp on the level of exit discharge is protected throughout by an approved automatic sprinkler system. All portions of the level of exit discharge with access to the egress path shall either be protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, or separated from the egress path in accordance with the requirements for the enclosure of interior exit stairways or ramps.
2. A maximum of 50 percent of the number and capacity of the interior exit stairways and ramps is permitted to egress through a vestibule provided all of the following are met:
  - 2.1. The entire area of the vestibule is separated from areas below by construction conforming to the fire-resistance rating for the enclosure.

- 2.2. The depth from the exterior of the building is not greater than 10 feet (3048 mm) and the length is not greater than 30 feet (9144 mm).
- 2.3. The area is separated from the remainder of the level of exit discharge by construction providing protection at least the equivalent of approved wired glass in steel frames.
- 2.4. The area is used only for means of egress and exits directly to the outside.
3. Horizontal exits complying with Section 1025 shall not be required to discharge directly to the exterior of the building.

**1027.2 Exit discharge capacity.** The capacity of the exit discharge shall be not less than the required discharge capacity of the *exits* being served.

**1027.3 Exit discharge components.** Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.

**1027.4 Egress courts.** Egress courts serving as a portion of the exit discharge in the means of egress system shall comply with the requirements of Section 1027.

**1027.4.1 Width.** The minimum width of egress courts shall be determined as specified in Section 1005.1, but such width shall not be less than 44 inches (1118 mm), except as specified herein. Egress courts serving Group R-3 and U occupancies shall not be less than 36 inches (914 mm) in width. The required width of egress courts shall be unobstructed to a height of 7 feet (2134 mm).

**Exception:** Encroachments complying with Section 1005.7.

Where an egress court exceeds the minimum required width and the width of such egress court is then reduced along the path of exit travel, the reduction in width shall be gradual. The transition in width shall be affected by a guard not less than 36 inches (914 mm) in height and shall not create an angle of more than 30 degrees (0.52 rad) with respect to the axis of the egress court along the path of egress travel. In no case shall the width of the egress court be less than the required minimum.

**1027.4.2 Construction and openings.** Where an egress court serving a building or portion thereof is less than 10 feet (3048 mm) in width, the egress court walls shall have not less than 1-hour fire-resistance-rated construction for a distance of 10 feet (3048 mm) above the floor of the court. Openings within such walls shall be protected by opening protectives having a fire protection rating of not less than <sup>3</sup>/<sub>4</sub> hour.

### Exceptions:

1. Egress courts serving an occupant load of less than 10.
2. Egress courts serving Group R-3.



**1027.5 Access to a public way.** The exit discharge shall provide a direct and unobstructed access to a public way.

**Exception:** Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate at least 5 square feet (0.46 m<sup>2</sup>) for each person.
2. *For other than Group E buildings*, the area shall be located on the same lot at least 50 feet (15 240 mm) away from the building requiring egress. *For Group E buildings*, the area shall be located on the same lot at least 50 feet (15 240 mm) away from any building.
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the building.

## SECTION 1028 ASSEMBLY

**1028.1 General.** A room or space used for assembly purposes which contains seats, tables, displays, equipment or other material shall comply with this section.

**Exception:** Group A occupancies within Group I-3 facilities are exempt from egress requirements of 1028.

**1028.1.1 Bleachers.** Bleachers, grandstands and folding and telescopic seating, that are not building elements, shall comply with ICC 300.

### 1028.1.1.1 Spaces under grandstands and bleachers.

When spaces under grandstands or bleachers are used for purposes other than ticket booths less than 100 square feet (9.29 m<sup>2</sup>) and toilet rooms, such spaces shall be separated by fire barriers complying with Section 707 and horizontal assemblies complying with Section 711 with not less than 1-hour fire-resistance-rated construction.

**1028.2 Assembly main exit.** In a building, room or space used for assembly purposes that has an occupant load of greater than 300 and is provided with a main exit, the main exit shall be of sufficient width to accommodate not less than one-half of the occupant load, but such width shall not be less than the total required width of all means of egress leading to the exit. Where the building is classified as a Group A occupancy, the main exit shall front on at least one street or an unoccupied space of not less than 20 feet (6096 mm) in width that adjoins a street or public way. In a building, room or space used for assembly purposes where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width *and at least one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in width that adjoins a street or public way.* Smoke-protected seating shall comply with Section 1028.6.2..

**1028.3 Assembly other exits.** In addition to having access to a main exit, each level in a building used for assembly purposes having an occupant load greater than 300 and provided with a main exit, shall be provided with additional means of egress that shall provide an egress capacity for at least one-half of the total occupant load served by that level and shall comply with Section 1015.2. *At least one-half of the additional means of egress required by this section shall be directly to an exit, or through a lobby, that is not used to access the main exit, to an exit, or to a one hour rated corridor to an exit.* In a building used for assembly purposes where there is no well-defined main exit or where multiple main exits are provided, exits for each level shall be permitted to be distributed around the perimeter of the building, provided that the total width of egress is not less than 100 percent of the required width *and at least one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in width that adjoins a street or public way.* Smoke-protected seating shall comply with Section 1028.6.2.

**1028.3.1 Occupant loads 300 or less.** Group A occupancies or assembly occupancies accessory to Group E occupancies that have an occupant load of 100 or more and 300 or less, shall have at least one of the required means of egress directly to an exit, or through a lobby, that is not used to access the other required exit, to an exit, or to a one-hour rated corridor to an exit or continuous through a one-hour rated lobby to an exit. *At least one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in width that adjoins a street or public way.*

**1028.4 Foyers and lobbies.** In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available, such persons shall be allowed to wait in a lobby or similar space, provided such lobby or similar space shall not encroach upon the required clear width of the means of egress. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.

**1028.5 Interior balcony and gallery means of egress.** For balconies, galleries or press boxes having a seating capacity of 50 or more located in a building, room or space used for assembly purposes, at least two means of egress shall be provided, with one from each side of every balcony, gallery or press box and at least one leading directly to an exit.

**1028.6 Width of means of egress for assembly.** The clear width of aisles and other means of egress shall comply with Section 1028.6.1 where smoke-protected seating is not provided and with Section 1028.6.2 or 1028.6.3 where smoke-protected seating is provided. The clear width shall be measured to walls, edges of seating and tread edges except for permitted projections.

**1028.6.1 Without smoke protection.** The clear width of the means of egress shall provide sufficient capacity in accordance with all of the following, as applicable:

1. At least 0.3 inch (7.6 mm) of width for each occupant served shall be provided on stairs having riser heights 7 inches (178 mm) or less and tread depths

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11 inches (279 mm) or greater, measured horizontally between tread nosings.

2. At least 0.005 inch (0.127 mm) of additional stair width for each occupant shall be provided for each 0.10 inch (2.5 mm) of riser height above 7 inches (178 mm).
3. Where egress requires stair descent, at least 0.075 inch (1.9 mm) of additional width for each occupant shall be provided on those portions of stair width having no handrail within a horizontal distance of 30 inches (762 mm).
4. Ramped means of egress, where slopes are steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.22 inch (5.6 mm) of clear width for each occupant served. Level or ramped means of egress, where slopes are not steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.20 inch (5.1 mm) of clear width for each occupant served.

**1028.6.2 Smoke-protected seating.** The clear width of the means of egress for smoke-protected assembly seating shall not be less than the occupant load served by the egress element multiplied by the appropriate factor in Table 1028.6.2. The total number of seats specified shall be those within the space exposed to the same smoke-protected environment. Interpolation is permitted between the specific values shown. A life safety evaluation, complying with NFPA 101, shall be done for a facility utilizing the reduced width requirements of Table 1028.6.2 for smoke-protected assembly seating.

**Exception:** For an outdoor smoke-protected assembly seating with an occupant load not greater than 18,000, the clear width shall be determined using the factors in Section 1028.6.3.

**1028.6.2.1 Smoke control.** Means of egress serving a smoke-protected assembly seating area shall be provided with a smoke control system complying with Section 909 or natural ventilation designed to maintain the smoke level at least 6 feet (1829 mm) above the floor of the means of egress.

**1028.6.2.2 Roof height.** A smoke-protected assembly seating area with a roof shall have the lowest portion of

the roof deck not less than 15 feet (4572 mm) above the highest aisle or aisle accessway.

**Exception:** A roof canopy in an outdoor stadium shall be permitted to be less than 15 feet (4572 mm) above the highest aisle or aisle accessway provided that there are no objects less than 80 inches (2032 mm) above the highest aisle or aisle accessway.

**1028.6.2.3 Automatic sprinklers.** Enclosed areas with walls and ceilings in buildings or structures containing smoke-protected assembly seating shall be protected with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

### Exceptions:

1. The floor area used for contests, performances or entertainment provided the roof construction is more than 50 feet (15 240 mm) above the floor level and the use is restricted to low fire hazard uses.
2. Press boxes and storage facilities less than 1,000 square feet (93 m<sup>2</sup>) in area.
3. Outdoor seating facilities where seating and the means of egress in the seating area are essentially open to the outside.

**1028.6.3 Width of means of egress for outdoor smoke-protected assembly seating.** The clear width in inches (mm) of aisles and other means of egress shall be not less than the total occupant load served by the egress element multiplied by 0.08 (2.0 mm) where egress is by aisles and stairs and multiplied by 0.06 (1.52 mm) where egress is by ramps, corridors, tunnels or vomitories.

**Exception:** The clear width in inches (mm) of aisles and other means of egress shall be permitted to comply with Section 1028.6.2 for the number of seats in the outdoor smoke-protected assembly seating where Section 1028.6.2 permits less width.

**1028.6.4 Public address system.** See section 907.2.1.2.

**1028.7 Travel distance.** Exits and aisles shall be so located that the travel distance to an exit door shall not be greater than 200 feet (60 960 mm) measured along the line of travel in nonsprinklered buildings. Travel distance shall not be more than 250 feet (76 200 mm) in sprinklered buildings. Where aisles are provided for seating, the distance shall be measured

**TABLE 1028.6.2  
WIDTH OF AISLES FOR SMOKE-PROTECTED ASSEMBLY**

TOTAL NUMBER OF SEATS IN THE SMOKEPROTECTED ASSEMBLY SEATING	INCHES OF CLEAR WIDTH PER SEAT SERVED			
	Stairs and aisle steps with handrails within 30 inches	Stairs and aisle steps without handrails within 30 inches	Passageways, doorways and ramps not steeper than 1 in 10 in slope	Ramps steeper than 1 in 10 in slope
Equal to or less than 5,000	0.200	0.250	0.150	0.165
10,000	0.130	0.163	0.100	0.110
15,000	0.096	0.120	0.070	0.077
20,000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.060	0.075	0.044	0.048

For SI: 1 inch = 25.4 mm.

along the aisles and aisle accessway without travel over or on the seats.

**Exceptions:**

1. Smoke-protected assembly seating: The travel distance from each seat to the nearest entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The travel distance from the entrance to the vomitory or concourse to a stair, ramp or walk on the exterior of the building shall not exceed 200 feet (60 960 mm).
2. Open-air seating: The travel distance from each seat to the building exterior shall not exceed 400 feet (122 m). The travel distance shall not be limited in facilities of Type I or II construction.

**1028.8 Common path of egress travel.** The common path of egress travel shall not exceed 30 feet (9144 mm) from any seat to a point where an occupant has a choice of two paths of egress travel to two exits.

**Exceptions:**

1. For areas serving less than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm).
2. For smoke-protected assembly seating, the common path of egress travel shall not exceed 50 feet (15 240 mm).

**1028.8.1 Path through adjacent row.** Where one of the two paths of travel is across the aisle through a row of seats to another aisle, there shall be not more than 24 seats between the two aisles, and the minimum clear width between rows for the row between the two aisles shall be 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row between aisles.

**Exception:** For smoke-protected assembly seating there shall not be more than 40 seats between the two aisles and the minimum clear width shall be 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat.

**1028.9 Assembly aisles are required.** Every occupied portion of any building, room or space used for assembly purposes that contains seats, tables, displays, similar fixtures or equipment shall be provided with aisles leading to exits or exit access doorways in accordance with this section. Aisle accessways for tables and seating shall comply with Section 1028.10.1.

**1028.9.1 Minimum aisle width.** The minimum clear width for aisles shall be as shown:

1. Forty-eight inches (1219 mm) for aisle stairs having seating on each side.  
**Exception:** Thirty-six inches (914 mm) where the aisle serves less than 50 seats.
2. Thirty-six inches (914 mm) for aisle stairs having seating on only one side.

**Exception:** Twenty-three inches (584 mm) between an aisle stair handrail and seating where

an aisle does not serve more than five rows on one side.

3. Twenty-three inches (584 mm) between an aisle stair handrail or guard and seating where the aisle is subdivided by a handrail.
4. Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

**Exceptions:**

1. Thirty-six inches (914 mm) where the aisle serves less than 50 seats.
2. Thirty inches (762 mm) where the aisle does not serve more than 14 seats.
5. Thirty-six inches (914 mm) for level or ramped aisles having seating on only one side.
6. *Libraries with open book stacks shall have main aisles not less than 44 inches (1118 mm) in width, and side, range and end aisles not less than 36 inches (914 mm) in width.*

**Exception:** Thirty inches (762 mm) where the aisle does not serve more than 14 seats.

**1028.9.2 Aisle width.** The aisle width shall provide sufficient egress capacity for the number of persons accommodated by the catchment area served by the aisle. The catchment area served by an aisle is that portion of the total space that is served by that section of the aisle. In establishing catchment areas, the assumption shall be made that there is a balanced use of all means of egress, with the number of persons in proportion to egress capacity.

**1028.9.3 Converging aisles.** Where aisles converge to form a single path of egress travel, the required egress capacity of that path shall not be less than the combined required capacity of the converging aisles.

**1028.9.4 Uniform width.** Those portions of aisles, where egress is possible in either of two directions, shall be uniform in required width.

**1028.9.5 Assembly aisle termination.** Each end of an aisle shall terminate at cross aisle, foyer, doorway, vomitory or concourse having access to an exit.

**Exceptions:**

1. Dead-end aisles shall not be greater than 20 feet (6096 mm) in length.
2. Dead-end aisles longer than 20 feet (6096 mm) are permitted where seats beyond the 20-foot (6096 mm) dead-end aisle are no more than 24 seats from another aisle, measured along a row of seats having a minimum clear width of 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row.
3. For smoke-protected assembly seating, the dead-end aisle length of vertical aisles shall not exceed a distance of 21 rows.
4. For smoke-protected assembly seating, a longer dead-end aisle is permitted where seats beyond

the 21-row dead-end aisle are not more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat above seven in the row.

**1028.9.6 Assembly aisle obstructions.** There shall be no obstructions in the required width of aisles except for handrails as provided in Section 1028.13.

**1028.10 Aisle accessways.** Aisle accessways for seating at tables shall comply with Section 1028.10.1. Aisle accessways for seating in rows shall comply with Section 1028.10.2.

**1028.10.1 Seating at tables.** Where seating is located at a table or counter and is adjacent to an aisle or aisle accessway, the measurement of required clear width of the aisle or aisle accessway shall be made to a line 19 inches (483 mm) away from and parallel to the edge of the table or counter. The 19-inch (483 mm) distance shall be measured perpendicular to the side of the table or counter. In the case of other side boundaries for aisle or aisle accessways, the clear width shall be measured to walls, edges of seating and tread edges, except that handrail projections are permitted.

**Exception:** Where tables or counters are served by fixed seats, the width of the aisle accessway shall be measured from the back of the seat.

**1028.10.1.1 Aisle accessway width for seating at tables.** Aisle accessways serving arrangements of seating at tables or counters shall have sufficient clear width to conform to the capacity requirements of Section 1005.1 but shall not have less than a minimum of 12 inches (305 mm) of width plus  $\frac{1}{2}$  inch (12.7 mm) of width for each additional 1 foot (305 mm), or fraction thereof, beyond 12 feet (3658 mm) of aisle accessway length measured from the center of the seat farthest from an aisle.

**Exception:** Portions of an aisle accessway having a length not exceeding 6 feet (1829 mm) and used by a total of not more than four persons.

**1028.10.1.2 Seating at table aisle accessway length.** The length of travel along the aisle accessway shall not exceed 30 feet (9144 mm) from any seat to the point where a person has a choice of two or more paths of egress travel to separate exits.

**1028.10.2 Clear width of aisle accessways serving seating in rows.** Where seating rows have 14 or fewer seats, the minimum clear aisle accessway width shall not be less than 12 inches (305 mm) measured as the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Where chairs have automatic or self-rising seats, the measurement shall be made with seats in the raised position. Where any chair in the row does not have an automatic or self-rising seat, the measurements shall be made with the seat in the down position. For seats with folding tablet arms, row spacing shall be determined with the tablet arm in the used position.

**Exception:** For seats with folding tablet arms, row spacing is permitted to be determined with the tablet arm in the stored position where the tablet arm when raised manually to vertical position in one motion automatically returns to the stored position by force of gravity.

**1028.10.2.1 Dual access.** For rows of seating served by aisles or doorways at both ends, there shall not be more than 100 seats per row. The minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.3 inch (7.6 mm) for every additional seat beyond 14 seats, but the minimum clear width is not required to exceed 22 inches (559 mm).

**Exception:** For smoke-protected assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1028.10.2.1.

**TABLE 1028.10.2.1  
SMOKE-PROTECTED ASSEMBLY AISLE ACCESSWAYS**

TOTAL NUMBER OF SEATS IN THE SMOKEPROTECTED ASSEMBLY SEATING	MAXIMUM NUMBER OF SEATS PER ROW PERMITTED TO HAVE A MINIMUM 12-INCH CLEAR WIDTH AISLE ACCESSWAY	
	Aisle or doorway at both ends of row	Aisle or doorway at one end of row only
Less than 4,000	14	7
4,000	15	7
7,000	16	8
10,000	17	8
13,000	18	9
16,000	19	9
19,000	20	10
22,000 and greater	21	11

For SI: 1 inch = 25.4 mm.

**1028.10.2.2 Single access.** For rows of seating served by an aisle or doorway at only one end of the row, the minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.6 inch (15.2 mm) for every additional seat beyond seven seats, but the minimum clear width is not required to exceed 22 inches (559 mm).

**Exception:** For smoke-protected assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1028.10.2.1.

**1028.11 Assembly aisle walking surfaces.** Aisles with a slope not exceeding one unit vertical in eight units horizontal (12.5-percent slope) shall consist of a ramp having a slip-resistant walking surface. Aisles with a slope exceeding one unit vertical in eight units horizontal (12.5-percent slope) shall consist of a series of risers and treads that extends across the full width of aisles and complies with Sections 1028.11.1 through 1028.11.3.

**1028.11.1 Treads.** Tread depths shall be a minimum of 11 inches (279 mm) and shall have dimensional uniformity.

**Exception:** The tolerance between adjacent treads shall not exceed  $\frac{3}{16}$  inch (4.8 mm).

**1028.11.2 Risers.** Where the gradient of aisle stairs is to be the same as the gradient of adjoining seating areas, the riser height shall not be less than 4 inches (102 mm) nor more than 8 inches (203 mm) and shall be uniform within each flight.

**Exceptions:**

1. Riser height nonuniformity shall be limited to the extent necessitated by changes in the gradient of the adjoining seating area to maintain adequate sightlines. Where nonuniformities exceed  $\frac{3}{16}$  inch (4.8 mm) between adjacent risers, the exact location of such nonuniformities shall be indicated with a distinctive marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform risers. Such stripe shall be a minimum of 1 inch (25 mm), and a maximum of 2 inches (51 mm), wide. The edge marking stripe shall be distinctively different from the contrasting marking stripe.
2. Riser heights not exceeding 9 inches (229 mm) shall be permitted where they are necessitated by the slope of the adjacent seating areas to maintain sightlines.

**1028.11.3 Tread contrasting marking stripe.** A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be a minimum of 1 inch (25 mm), and a maximum of 2 inches (51 mm), wide.

**Exception:** The contrasting marking stripe is permitted to be omitted where tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

**1028.12 Seat stability.** In a building, room or space used for assembly purposes, the seats shall be securely fastened to the floor.

**Exceptions:**

1. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered floors for seating and with 200 or fewer seats, the seats shall not be required to be fastened to the floor.
2. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered floors for seating, the seats shall not be required to be fastened to the floor.
3. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered floors for seating and with greater than 200 seats, the seats shall be fastened together in groups of not less

than three or the seats shall be securely fastened to the floor.

4. In a building, room or space used for assembly purposes where flexibility of the seating arrangement is an integral part of the design and function of the space and seating is on tiered levels, a maximum of 200 seats shall not be required to be fastened to the floor. Plans showing seating, tiers and aisles shall be submitted for approval.
5. Groups of seats within a building, room or space used for assembly purposes separated from other seating by railings, guards, partial height walls or similar barriers with level floors and having no more than 14 seats per group shall not be required to be fastened to the floor.
6. Seats intended for musicians or other performers and separated by railings, guards, partial height walls or similar barriers shall not be required to be fastened to the floor.

**1028.13 Handrails.** Ramped aisles having a slope exceeding one unit vertical in 15 units horizontal (6.7-percent slope) and aisle stairs shall be provided with handrails in compliance with Section 1012 located either at one or both sides of the aisle or within the aisle width.

**Exceptions:**

1. Handrails are not required for ramped aisles having a gradient no greater than one unit vertical in eight units horizontal (12.5-percent slope) and seating on both sides.
2. Handrails are not required if, at the side of the aisle, there is a guard that complies with the graspability requirements of handrails.
3. Handrail extensions are not required at the top and bottom of aisle stair and aisle ramp runs to permit crossovers within the aisles.

**1028.13.1 Discontinuous handrails.** Where there is seating on both sides of the aisle, the handrails shall be discontinuous with gaps or breaks at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of at least 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the handrail shall have rounded terminations or bends.

**1028.13.2 Intermediate handrails.** Where handrails are provided in the middle of aisle stairs, there shall be an additional intermediate handrail located approximately 12 inches (305 mm) below the main handrail.

**1028.14 Assembly guards.** Guards adjacent to seating in a building, room or space used for assembly purposes shall comply with Sections 1028.14.1 through 1028.14.3.

**1028.14.1 Cross aisles.** Cross aisles located more than 30 inches (762 mm) above the floor or grade below shall have guards in accordance with Section 1013.

Where an elevation change of 30 inches (762 mm) or less occurs between a cross aisle and the adjacent floor or grade below, guards not less than 26 inches (660 mm) above the aisle floor shall be provided.

**Exception:** Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guard need not be provided.

**1028.14.2 Sightline-constrained guard heights.** Unless subject to the requirements of Section 1028.14.3, a fascia or railing system in accordance with the guard requirements of Section 1013 and having a minimum height of 26 inches (660 mm) shall be provided where the floor or foot-board elevation is more than 30 inches (762 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating. At bleachers, a guard must be provided where required by ICC 300.

**Exception:** The height of the guard in front of seating shall be measured from the adjacent walking surface.

**1028.14.3 Guards at the end of aisles.** A fascia or railing system complying with the guard requirements of Section 1013 shall be provided for the full width of the aisle where the foot of the aisle is more than 30 inches (762 mm) above the floor or grade below. The fascia or railing shall be a minimum of 36 inches (914 mm) high and shall provide a minimum 42 inches (1067 mm) measured diagonally between the top of the rail and the nosing of the nearest tread.

## SECTION 1029 EMERGENCY ESCAPE AND RESCUE

**1029.1 General.** In addition to the means of egress required by this chapter, provisions shall be made for emergency escape and rescue openings in Group R-2 occupancies in accordance with Tables 1021.2(1) and 1021.2(2) and Group R-3 occupancies. Basements and sleeping rooms below the fourth story above grade plane shall have at least one exterior emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, emergency escape and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way or to a yard or court that opens to a public way.

### Exceptions:

1. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
2. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior exit balcony that opens to a public way.
3. Basements without habitable spaces and having no more than 200 square feet (18.6 m<sup>2</sup>) in floor area

shall not be required to have emergency escape and rescue openings.

**1029.2 Minimum size.** Emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.53 m<sup>2</sup>).

**Exception:** The minimum net clear opening for grade-floor emergency escape and rescue openings shall be 5 square feet (0.46 m<sup>2</sup>).

**1029.2.1 Minimum dimensions.** The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

**1029.3 Maximum height from floor.** Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) measured from the floor.

**1029.4 Operational constraints.** Emergency escape and rescue openings shall be *maintained free of any obstructions other than those allowed by this section and shall be operational from the inside of the room without the use of keys or tools.* Bars, grilles, grates or similar devices are permitted to be placed over emergency escape and rescue openings provided the minimum net clear opening size complies with Section 1029.2 and such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening. Where such bars, grilles, grates or similar devices are installed in existing buildings, smoke alarms shall be installed in accordance with Section 907.2.11 regardless of the valuation of the alteration. *The release mechanism shall be maintained operable at all times.*

*Such bars, grills, grates or any similar devices shall be equipped with an approved exterior release device for use by the fire department only when required by the authority having jurisdiction.*

*Where security bars (burglar bars) are installed on emergency egress and rescue windows or doors, on or after July 1, 2000, such devices shall comply with California Building Standards Code, Part 12, Chapter 12-3 and other applicable provisions of Part 2.*

**Exception:** *Group R-1 occupancies provided with a monitored fire sprinkler system in accordance with Section 903.2.8 and designed in accordance with NFPA 13 may have operable windows permanently restricted to a maximum 4-inch (102 mm) open position.*

**1029.5 Window wells.** An emergency escape and rescue opening with a finished sill height below the adjacent ground level shall be provided with a window well in accordance with Sections 1029.5.1 and 1029.5.2.

**1029.5.1 Minimum size.** The minimum horizontal area of the window well shall be 9 square feet (0.84 m<sup>2</sup>), with a minimum dimension of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

**1029.5.2 Ladders or steps.** Window wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or steps. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the window well. The ladder or steps shall not encroach into the required dimensions of the window well by more than 6 inches (152 mm). The ladder or steps shall not be obstructed by the emergency escape and rescue opening. Ladders or steps required by this section are exempt from the stairway requirements of Section 1009.





## **CHAPTER 11**

# **RESERVED**



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 11A – HOUSING ACCESSIBILITY

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>			X	X	X															
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>						X														
<i>Chapter / Section</i>																				
1102A.3.1, Exc.																				
1102A.2, Exc.																				
1118A.1																				
1128A						X														
1129A						X														
1130A						X														
1131A						X														
1132A						X														
1133A						X														
1134A						X														
1135A						X														
1136A						X														
1150A.1						X														



## CHAPTER 11A

# HOUSING ACCESSIBILITY

**NOTE:** Dwelling units constructed as senior citizen housing may also be subject to the Unruh Civil Rights Act. Refer to Division I, Part 2 of the California Civil Code. For additional information regarding application, interpretation and enforcement, contact the California Department of Fair Employment and Housing.

### Division I – APPLICATION, GENERAL PROVISIONS, AND DEFINITIONS

#### Division I Table of Contents

- Section 1101A Application
- Section 1102A Building Accessibility
- Section 1103A Design and Construction
- Section 1104A Covered Multifamily Dwellings
- Section 1105A Garages, Carports and Parking Facilities
- Section 1106A Site and Building Characteristics
- Section 1107A Definitions

### SECTION 1101A APPLICATION

**1101A.1 Scope.** The application and authority of this chapter are identified and referenced in Sections 1.8.2.1.2 and 1102A for the Department of Housing and Community Development. Applicable sections are identified in the Matrix Adoption Tables of this code under the abbreviation HCD 1-AC. The provisions of this chapter shall apply to the following:

1. All newly-constructed covered multifamily dwellings.
2. New common use spaces serving existing covered multifamily dwellings.
3. Additions to existing buildings, where the addition alone meets the definition of a covered multifamily dwelling.
4. Common-use areas serving covered multifamily dwellings.
5. Where any portion of a building's exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings, the building is considered a new building for determining the application of this chapter.

These building standards generally do not apply to public accommodations such as hotels and motels. Public use areas, public accommodations, and public housing as defined in Chapter 2 of this code are subject to provisions of the Division of the State Architect (DSA-AC) and are referenced in Section 1.9.1.1.

### SECTION 1102A BUILDING ACCESSIBILITY

**1102A.1 Where required.** Buildings or portions of buildings and facilities within the scope of this chapter shall be accessible to persons with disabilities. Each building on a building site shall be considered separately when determining the

requirements contained in this chapter, except when calculating the number of units which must comply with Section 1102A.3.1. Dwelling units within a single structure separated by firewalls do not constitute separate buildings.

Newly-constructed covered multifamily dwellings as defined in this chapter, include, but are not limited to, the following:

1. Apartment buildings with 3 or more dwelling units including timeshare apartments not considered a place of public accommodation or transient lodging as defined in Health and Safety Code Section 19955 (a), and Chapter 2 of the California Building Code.
2. Condominiums with 4 or more dwelling units including timeshare condominiums not considered a place of public accommodation or transient lodging as defined in Health and Safety Code Section 19955 (a), and Chapter 2 of the California Building Code.
3. Lodging houses, as defined in Chapter 2 of the California Building Code, used as a residence with more than 3 but not more than 5 guest rooms.
4. Congregate residences, as defined in Chapter 2 of the California Building Code.
5. Dwellings with 3 or more efficiency units, as defined in Chapter 2 of this code, or Section 17958.1 of the California Health and Safety Code.
6. Shelters for homeless persons, not otherwise subject to the disabled access provisions of the Division of the State Architect-Access Compliance (DSA-AC).
7. Dormitories, as defined in Chapter 2 of this code, with 3 or more guest rooms as defined in Chapter 2 of the California Building Code.
8. Timeshare dwellings with 3 or more units, not considered a place of public accommodations or transient lodging as defined in Health and Safety Code Section 19955 (a), and Chapter 2 of the California Building Code.
9. Other Group R occupancies in covered multifamily dwellings which are regulated by the Office of the State Fire Marshal. See Section 1.11.
10. Public housing as defined in Chapter 2 of this code is subject to provisions of the Division of the State Architect (DSA-AC). See Chapter 11B.

**1102A.2 Existing buildings.** The building standards contained in this chapter do not apply to the alteration, repair, rehabilitation or maintenance of multifamily dwellings constructed for first occupancy prior to March 13, 1991. Public housing as defined in Chapter 2 of this code is subject to pro-

visions of the Division of the State Architect (DSA-AC). See Chapter 11B.

Covered multifamily dwellings shall be maintained in compliance with the accessibility standards in effect at the time of construction. Apartments constructed prior to March 13, 1991, shall be maintained in compliance with the accessibility standards in effect at the time of construction.

Additions shall be subject to the requirements of this chapter, provided the addition, when considered alone, meets the definition of a covered multifamily dwelling, as defined in Chapter 2. New common use spaces serving existing covered multifamily dwellings shall be subject to the requirements of this chapter.

**Note:** For all existing public use areas, public accommodations, and public housing, see Chapter 11B, for provisions of the Division of the State Architect-Access Compliance (DSA-AC).

### 1102A.3 Multifamily dwellings.

**1102A.3.1 Multistory apartment or condominium dwellings in buildings with no elevator.** This section shall apply to multistory dwelling units on the ground floor of buildings without elevators for which an application for a construction permit is submitted on or after July 1, 2005.

**Exception:** Carriage units as defined in Chapter 2 and regulated only by the Department of Housing and Community Development as referenced in Section 1.8.2.1.2.

At least 10 percent but not less than one of the multistory dwellings in apartment buildings with 3 or more dwelling units and/or condominiums with 4 or more dwelling units shall comply with the following:

1. The primary entry to the dwelling unit shall be on an accessible route unless exempted by site impracticability tests in Section 1150A.
2. At least one powder room or bathroom shall be located on the primary entry level, served by an accessible route and shall comply with the provisions in Division IV.
3. All rooms or spaces located on the primary entry level shall be served by an accessible route and shall comply with the provisions in Division IV. Rooms and spaces located on the primary entry level and subject to this chapter may include but are not limited to kitchens, powder rooms, bathrooms, living rooms, bedrooms or hallways.
4. Common use areas covered by this section shall be accessible as required by this chapter. Public use areas as defined in Chapter 2 of this code are subject to provisions of the Division of the State Architect (DSA-AC) and are referenced in Section 1.9.1.1.

The minimum number of multifamily dwelling units which must comply with this section shall be calculated using the total number of all multistory dwelling units in buildings on a site which are subject to this section. Any

fraction thereof shall be rounded to the next highest whole number.

**1102A.3.2 Multistory dwelling units in buildings with one or more elevators.** Multistory dwelling units contained in buildings with elevators shall comply with this section. For multistory dwelling units in buildings with elevators, the story of the unit that is served by the building elevator is considered a ground floor and the primary entry floor to the unit and shall comply with the following:

1. At least 1 powder room or bathroom shall be located on the primary entry level.
2. All rooms or spaces located on the primary entry level shall be served by an accessible route and shall comply with Division IV.

**1102A.4 Swimming pools.** Swimming pools and spas required to be accessible shall comply with the provisions of Section 1141A.

**1102A.5 Temporary restrictions.** During periods of partial or restricted use of a building or facility, the entrances used for primary access shall be accessible to and usable by persons with disabilities.

## SECTION 1103A DESIGN AND CONSTRUCTION

### 1103A.1 General.

**1103A.1.1** When buildings are required to be accessible, they shall be designed and constructed as provided in this chapter.

**Note:** Public use areas, public accommodations, and public housing as defined in Chapter 2 of this code are subject to provisions of the Division of the State Architect (DSA-AC) and are referenced in Section 1.9.1.1.

## SECTION 1104A COVERED MULTIFAMILY DWELLINGS

**1104A.1 General.** All ground-floor dwelling units in nonelevator buildings shall be adaptable and on an accessible route, unless an accessible route is not required as determined by site impracticability provisions in Section 1150A. For buildings with elevators, see Section 1106A.

Multistory dwelling units shall comply with Section 1102A.3.

**1104A.2 Ground floors above grade.** Where the first floor containing dwelling units in a building is above grade, all units on that floor shall be served by an accessible route. This floor will be considered a ground floor and all dwelling units are considered covered multifamily dwelling units.

**Exception:** Carriage units as defined in Chapter 2 and regulated only by the Department of Housing and Community Development as referenced in Section 1.8.2.1.2.

Multistory dwelling units shall comply with Section 1102A.3.

**SECTION 1105A****GARAGES, CARPORTS AND PARKING FACILITIES**

**1105A.1 General.** Garages, carports and other parking facilities, which are accessory to covered multifamily dwelling units, shall be accessible as required in Section 1109A.

**SECTION 1106A****SITE AND BUILDING CHARACTERISTICS**

**1106A.1 General.** Covered multifamily dwellings with elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route, regardless of terrain or unusual characteristics of the site. Covered multifamily dwellings without elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route unless terrain or unusual characteristics of the site prevent an accessible route based on the conditions listed below:

1. **Accessible entrance.** Regardless of site considerations described in Section 1150A, an accessible entrance on an accessible route is required when there is an elevator connecting the parking area with the dwelling units on a ground floor. (In this case, those dwelling units on the ground floor served by an elevator, and at least one of each type of public- and common-use areas, would be subject to these requirements.)
2. **Elevator building.** When a building elevator or elevators are provided as a means of access to dwelling units other than dwelling units on a ground floor (see Section 1104A.2), the building is an elevator building. All dwelling units become covered multifamily dwellings in

that building. The elevator in that building must provide accessibility to all dwelling units in the building, regardless of the slope of the natural terrain. For multistory dwelling units in buildings with one or more elevators, see Section 1102A.3.2.

**Note:** Where a building elevator is provided only as means of creating an accessible route to covered multifamily dwelling units on a ground floor, the building is not considered to be an elevator building, only dwelling units located on the ground floor shall be required to comply with this chapter.

3. **Elevated walkway.** When an elevated walkway is planned between a building entrance and a vehicular or pedestrian arrival point, and the planned walkway has a slope no greater than 10 percent (1 unit vertical in 10 units horizontal), the floor being served by the elevated walkway becomes a ground floor and accessibility to all dwellings on that ground floor is required.

**Note:** Since the planned walkway meets the 10 percent slope criterion, it is required to provide an accessible route to the entrance, and the slope of the walkway must be reduced to 1 unit vertical in 12 units horizontal (8.33 percent slope) maximum.

**1106A.2 Site impracticability.** For tests to determine site impracticability due to terrain considerations in nonelevator buildings, see Section 1150A.

**SECTION 1107A  
DEFINITIONS**

All definitions are located in Chapter 2.

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**SECTION 1108A****GENERAL REQUIREMENTS FOR ACCESSIBLE PARKING AND EXTERIOR ROUTES OF TRAVEL****Notes:**

1. In addition to provisions of this division, exterior routes of travel that provide access to, or egress from, buildings for persons with disabilities shall also comply with Chapter 10.
2. Public use areas, public accommodations, and public housing as defined in Chapter 2 of this code are subject to provisions of the Division of the State Architect (DSA-AC) and are referenced in Section 1.9.1.1.

**SECTION 1109A  
PARKING FACILITIES**

**1109A.1 Accessible parking required.** Each parking facility provided for covered multifamily dwellings and facilities (e.g., swimming pools, club houses, recreation areas and laundry rooms) that serve covered multifamily dwellings shall provide accessible parking as required by this section.

**1109A.2 Parking facilities.** Parking facilities shall include, but not be limited to, the following:

1. Garages
2. Private garages
3. Carports
4. Off-street parking (parking lots/spaces)

**1109A.2.1 Private garages.** Private garages accessory to covered multifamily dwelling units, shall be accessible as required in Section 1109A. Private garages include individual garages and multiple individual garages grouped together.

**Exception:** An attached private garage directly serving a single covered multifamily dwelling unit providing at least one of the following options:

1. A door leading directly from the covered dwelling unit which immediately enters the garage.

The door shall comply on both sides with Sections 1132A.3 through 1132A.9.

2. An accessible route of travel from the covered dwelling unit to an exterior door entering the garage. See Section 1132A.1 for requirements at both exit doors.
3. An accessible route of travel from the dwelling unit's primary entry door to the vehicular entrance at the garage. See Section 1132A.1 for requirements at the primary entry door.

**1109A.3 Required accessible parking spaces.** Accessible parking spaces shall be provided at a minimum rate of 2 percent of the covered multifamily dwelling units. At least one space of each type of parking facility shall be made accessible even if the total number exceeds 2 percent.

**1109A.4 Assigned accessible parking spaces.** When assigned parking spaces are provided for a resident or a group of residents, at least 2 percent of the assigned parking spaces serving covered multifamily dwelling units shall be accessible in each type of parking facility. At least one space of each type of parking facility shall be made accessible even if the total number exceeds 2 percent. When assigned parking is provided, signage as required by Section 1109A.8.8 shall not be required.

**1109A.5 Unassigned and visitor parking spaces.** When parking is provided for covered multifamily dwellings and is not assigned to a resident or a group of residents at least 5 percent of the parking spaces shall be accessible and provide access to grade-level entrances of covered multifamily dwellings and facilities (e.g., swimming pools, club houses, recreation areas, and laundry rooms) that serve covered multifamily dwellings. Accessible parking spaces shall be provided with signage as required by Section 1109A.8.8. Such signage shall not be blocked from view by a vehicle parked in the space.

**1109A.6 Requests for accessible parking spaces.** When assigned parking is provided, designated accessible parking for the dwelling unit shall be provided on request of residents with disabilities on the same terms and with the full range of choices (e.g., off-street parking, carport or garage) that are available for other residents.

**1109A.7 Location of accessible parking spaces.** The location of accessible parking spaces shall comply with the following:

1. Accessible parking spaces shall be located on the shortest possible accessible route to an accessible building, or covered multifamily dwelling unit entrance. All van accessible spaces may be grouped on one level of a multilevel parking facility.
2. When parking facilities are located adjacent to a building with multiple accessible entrances, accessible parking spaces shall be dispersed and located near the accessible building entrances.
3. When practical, the accessible route shall not cross lanes for vehicular traffic. When crossing vehicle traffic lanes is necessary, the accessible route shall be designated and marked as a crosswalk.



4. *Parking facilities that do not serve a particular building shall have accessible parking spaces located on the shortest possible accessible route to an accessible pedestrian entrance of the parking facility.*
5. *Accessible parking spaces shall be located so that persons with disabilities are not compelled to wheel or walk behind parked cars other than their own.*

**Exception:** When the enforcement agency determines that compliance with this section or providing equivalent facilitation would create an unreasonable hardship, parking spaces may be provided which would require a person with physical disabilities to wheel or walk behind other than accessible parking spaces.

**1109A.8 Design and construction.** Accessible parking required by this section shall be designed and constructed in accordance with Section 1109A.

**1109A.8.1 Vertical clearances.** All entrances, exits and vehicular passageways to and from required accessible parking spaces within parking facilities, shall have a minimum vertical clearance of 8 feet 2 inches (2489 mm) from the floor to the lowest projection of the ceiling. Reflective warning signs complying with Chapter 11B for character height shall be installed at transitions from the 8 feet 2 inch ceiling to lower ceiling heights in vehicular passageways in the same parking level.

**1109A.8.2 Arrangement of parking spaces.** Parking spaces shall be arranged to comply with the following:

1. In each parking area, a bumper or curb shall be provided and located to prevent encroachment of cars over the required width of walkways.
2. Ramps, including curb ramps, shall not encroach into any accessible parking space or the adjacent loading and unloading access aisle.

**1109A.8.3 Slope of accessible parking spaces and access aisles.** Surface slopes of accessible parking spaces and access aisles shall be the minimum possible and shall not exceed  $\frac{1}{4}$  inch (6.35 mm) per foot (2.083-percent gradient) in any direction.

**1109A.8.4 Accessible parking space size.** Accessible parking spaces shall comply with Sections 1109A.8.5 and 1109A.8.6.

**1109A.8.5 Accessible single parking space.** Where accessible single spaces are provided, they shall be constructed in accordance with the following:

1. Single spaces shall be 14 feet (4267 mm) wide and lined to provide a 9-foot (2743 mm) wide parking area and a 5-foot (1524 mm) wide loading and unloading access aisle on the passenger side of the vehicle (see Figure 11A-2B) with the vehicle parked in the forward position.
2. When more than one space is provided, two 9-foot (2743 mm) wide parking spaces may be lined on each side of a 5-foot (1524 mm) wide loading and unloading access aisle (see Figures 11A-2A and 11A-2C).

3. The minimum length of each parking space shall be 18 feet (5486 mm).
4. The loading and unloading access aisle shall be marked by a border painted blue. Within the blue border, hatched lines a maximum of 36 inches (914 mm) on center shall be painted a color contrasting with the parking surface, preferably blue or white. The words "NO PARKING" shall be painted on the ground within each 5-foot (1524 mm) wide loading and unloading access aisle. This notice shall be painted in white letters no less than 12 inches (305 mm) high and located so that it is visible to traffic enforcement officials.

**Note:** See Figures 11A-2A, 11A-2B and 11A-2C.

**1109A.8.6 Van accessible parking space.** One in every eight accessible spaces, but not less than one, shall be van accessible and shall be constructed in accordance with the following:

1. Each space shall be served by a loading and unloading access aisle at least 8 feet (2438 mm) wide, placed on the passenger side with the vehicle parked in the forward position.
2. The minimum length of each space shall be 18 feet (5486 mm).
3. Each space shall be designated "van accessible" as required by Section 1109A.8.8.
4. All van accessible spaces may be grouped on one level of a multilevel parking facility.
5. The loading and unloading access aisle shall be marked by a border painted blue. Within the blue border, hatched lines a maximum of 36 inches (914 mm) on center shall be painted a color contrasting with the parking surface, preferably blue or white. The words "NO PARKING" shall be painted on the ground within each 8-foot (2438 mm) wide loading and unloading access aisle. This notice shall be painted in white letters no less than 12 inches (305 mm) high and located so that it is visible to traffic enforcement officials.

**Note:** See Figures 11A-2A, 11A-2B and 11A-2C.

**1109A.8.7 Adjacent parking.** Parking spaces adjacent to accessible parking spaces shall not be considered as loading and unloading access aisles.

**1109A.8.8 Parking signage.** Each accessible parking space reserved for persons with disabilities shall be identified by a reflective sign permanently posted immediately adjacent to and visible from each stall or space consisting of the "International Symbol of Accessibility" in white on a dark blue background. The sign shall not be smaller than 70 square inches (4516 mm<sup>2</sup>) in area and, when in a path of travel, shall be posted at a minimum height of 80 inches (2032 mm) from the bottom of the sign to the parking space finished grade. Signs may also be centered on the wall at the interior end of the parking space at a minimum height of 36 inches (914 mm) from the parking space finished grade, ground or sidewalk. Van accessible spaces

shall comply with Section 1109A.8.6 and shall have an additional sign or additional language stating “Van Accessible” below the symbol of accessibility.

**Note:** When assigned resident parking is provided, signage is not required except for unassigned or visitor parking spaces.

An additional sign shall also be posted in a conspicuous place at each entrance to off-street parking facilities or immediately adjacent to and visible from each accessible stall or space. The sign shall not be less than 17 inches (432 mm) by 22 inches (559 mm) in size with lettering not less than 1 inch (25.4 mm) in height, and shall clearly and conspicuously state the following:

“Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at the owner’s expense. Towed vehicles may be reclaimed at \_\_\_\_\_ or by telephoning \_\_\_\_\_.”

Blank spaces are to be filled in with appropriate information as a permanent part of the sign.

In addition to the above requirements, the surface of each accessible parking space shall have a surface identification duplicating either of the following schemes:

1. By outlining or painting the stall or space in blue and outlining on the ground in the stall or space in white or suitable contrasting color the “International Symbol of Accessibility”; or,
2. By outlining the “International Symbol of Accessibility” in white on blue background. The “International Symbol of Accessibility” shall be located so that it is visible to a traffic enforcement officer when a vehicle is properly parked in the space and shall be 36 inches high by 36 inches wide (914 mm by 914 mm).

**Note:** See Figures 11A-2A, 11A-2B and 11A-2C.

## SECTION 1110A EXTERIOR ROUTES OF TRAVEL

**1110A.1 Exterior accessible route.** When a building or portion of a building is required to be accessible or adaptable, an accessible route shall be provided to all portions of the building, accessible building entrances and between the building and the public way. The accessible route shall be the most practical direct route and to the maximum extent feasible, coincide with the route for the general public and building residents. Exterior accessible routes shall be provided as follows:

1. Where more than one route of travel is provided, all routes shall be accessible.
2. At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking and accessible passenger loading

and unloading zones, and public streets or sidewalks to the accessible building entrance they serve.

3. At least one accessible route shall connect accessible buildings, facilities, elements and spaces that are on the same site. Accessible routes shall be provided between accessible buildings and accessible site facilities when more than one building or facility is located on a site.
4. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces, elements, and covered multifamily dwelling units.
5. An accessible route shall connect at least one accessible entrance of each covered multifamily dwelling unit with exterior spaces and facilities that serve the dwelling unit.
6. Where elevators are provided for vertical access, all elevators shall be accessible. See Section 1124A.

**Note:** If the slope of the finished grade between covered multifamily dwellings and a public use or common use facility (including parking) exceeds 1 unit vertical in 12 units horizontal (8.33-percent slope), or where other physical barriers (natural or artificial) or legal restrictions, all of which are outside the control of the owner, prevent the installation of an accessible route, an acceptable alternative is to provide access by a vehicular route, provided:

1. There is accessible parking on an accessible route for at least 2 percent of the covered multifamily dwelling units, and
2. Necessary site provisions such as parking spaces and curb ramps are provided at the public use or common use facility.

**1110A.2 Signs.** At every primary public entrance and at every major junction where the accessible route diverges from the circulation path along or leading to an accessible route, entrance or facility, there shall be a sign displaying the “International Symbol of Accessibility.” Signs shall indicate the direction to accessible building entrances and facilities and shall comply with the requirements found in Section 1143A.2.

**1110A.3 Flooring.** Floor and ground surfaces shall be stable, firm, and slip resistant. If carpet or carpet tile is used in a common-use area or public-use area on a ground or floor surface, it shall have firm backing or no backing. Carpet or carpet tile shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. The maximum pile height shall be 1/2 inch (12.7 mm). Exposed edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with Section 1111A requirements for changes in level.

**1110A.3.1 Recessed doormats.** Recessed doormats shall be adequately anchored to prevent interference with wheelchair traffic.

**1110A.4 Exterior accessible routes over 200 feet.** Exterior accessible routes that exceed 200 feet (60 960 mm) in length shall comply with Section 1138A.1.2. (See Figure 11A-1L)

### SECTION 1111A CHANGES IN LEVEL ON ACCESSIBLE ROUTES

**1111A.1 Changes in level not exceeding  $\frac{1}{2}$  inch.** Abrupt changes in level along any accessible route shall not exceed  $\frac{1}{2}$  inch (12.7 mm). When changes in level do occur, they shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level not exceeding  $\frac{1}{4}$  inch (6.35 mm) may be vertical.

**1111A.2 Changes greater than  $\frac{1}{2}$  inch.** Changes in level greater than  $\frac{1}{2}$  inch (12.7 mm) shall be made by means of a sloped surface not greater than 1 unit vertical in 20 units horizontal (5-percent slope), or a curb ramp, ramp, elevator or platform (wheelchair) lift. Stairs shall not be part of an accessible route. When stairs are located along or adjacent to an accessible route they shall comply with Section 1115A for exterior stairways.

### SECTION 1112A CURB RAMPS ON ACCESSIBLE ROUTES

**1112A.1 General.** Curb ramps within the boundary of the site shall be constructed at each corner of street intersections and where a pedestrian way crosses a curb. The preferred and recommended location for curb ramps is in the center of the crosswalk of each street corner. Where it is necessary to locate a curb ramp in the center of the curb return, the street surfaces shall be marked to identify pedestrian crosswalks, and the lower end of the curb ramp shall terminate within such crosswalk areas. Curb ramps do not require handrails.

**1112A.2 Obstructions.** Curb ramps shall be located or protected to prevent obstruction by parked cars. Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces, or the adjacent loading and unloading access aisle.

**1112A.3 Width of curb ramps.** Curb ramps shall be a minimum of 48 inches (1219 mm) in width.

**1112A.4 Diagonal curb ramps.** If diagonal (or corner-type) curb ramps have returned curbs or other well-defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have a 48-inch (1219 mm) minimum clear space as shown in Figures 11A-3A through 11A-3M. If diagonal curb ramps are provided at marked crossings, the 48-inch (1219 mm) clear space shall be within the markings (see Figures 11A-3A through 11A-3M). If diagonal curb ramps have flared sides, they shall also have at least a 24-inch-long (610 mm) segment of straight curb located on each side of the curb ramp and within the marked crossing. See Figures 11A-3A through 11A-3M.

**1112A.5 Slope of curb ramps.** The slope of curb ramps shall not exceed 1 unit vertical to 12 units horizontal (8.33-percent slope) and shall lie, generally, in a single sloped plane. Transitions from ramps to walks, gutters or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining

gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1 unit vertical to 20 units horizontal (5-percent slope) within 4 feet (1219 mm) of the top and bottom of the curb ramp.

If a curb ramp is located where pedestrians must walk across the ramp, then it shall have flared sides; the maximum slope of the flare shall be 1 unit vertical in 10 units horizontal (10-percent slope). Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp. See Figures 11A-3A through 11A-3M.

**1112A.6 Level landing.** A level landing 48 inches (1219 mm) deep shall be provided at the upper end of each curb ramp over its full width to permit safe egress from the ramp surface, or the slope of the fanned or flared sides of the curb ramp, shall not exceed 1 unit vertical to 12 units horizontal (8.33-percent slope).

**1112A.7 Finish.** The surface of each curb ramp and its flared sides shall be stable, firm and slip-resistant and shall be of contrasting finish from that of the adjacent sidewalk.

**1112A.8 Border.** All curb ramps shall have a grooved border 12 inches (305 mm) wide at the level surface of the sidewalk along the top and each side approximately  $\frac{3}{4}$  inch (19 mm) on center. All curb ramps constructed between the face of the curb and the street shall have a grooved border at the level surface of the sidewalk. See Figures 11A-3A through 11A-3K.

**1112A.9 Detectable warnings.** See Chapter 11B.

### SECTION 1113A WALKS AND SIDEWALKS ON AN ACCESSIBLE ROUTE

**1113A.1 Width and continuous surface.** Walks and sidewalks subject to this chapter shall have a continuous common surface, not interrupted by steps or by abrupt changes in level exceeding  $\frac{1}{2}$  inch (12.7 mm). (See Section 1111A).

**1113A.1.1 Width.** Walks and sidewalks shall be a minimum of 48 inches (1219 mm) in width, except that walks serving an individual dwelling unit in covered multifamily buildings may be reduced to 36 inches (914 mm) in clear width except at doors.

**1113A.1.2 Surfaces.** Surfaces shall be slip-resistant as follows:

1. Surfaces with a slope of less than 6 percent gradient shall be at least as slip-resistant as that described as a medium salted finish.
2. Surfaces with a slope of 6 percent or greater gradient shall be slip-resistant.

**1113A.1.3 Surface cross slopes.** Surface cross slopes shall not exceed  $\frac{1}{4}$  inch (6.35 mm) per foot (2.083-percent slope) except when the enforcing agency finds that due to local conditions it creates an unreasonable hardship, the cross slope may be increased to a maximum of  $\frac{1}{2}$  inch (12.7 mm) per foot (4.2-percent slope) for distances not to exceed 20 feet (6096 mm).

**1113A.2 Walks with continuous gradients.** All walks on an accessible route with continuous gradients shall have level

areas at least 60 inches (1524 mm) in length at intervals of at least every 400 feet (122 m).

**1113A.3 Five percent gradient.** When the slope in the direction of travel of any walk on an accessible route exceeds 1 unit vertical in 20 units horizontal (5-percent slope), it shall comply with the ramp provisions of Section 1114A.

**1113A.4 Level areas.** Walks on an accessible route shall be provided with a level area not less than 60 inches by 60 inches (1524 mm by 1524 mm) at a door or gate that swings toward the walk, and not less than 48 inches wide by 44 inches (1219 mm by 1118 mm) deep at a door or gate that swings away from the walk. See Section 1126A.3.2 for strike edge maneuvering space at doors or gates.

**1113A.5 Smooth surface.** The bottom 10 inches (254 mm) of all doors and/or gates except automatic and sliding doors or gates shall have a smooth, uninterrupted surface to allow the door or gate to be opened by a wheelchair footrest without creating a trap or hazardous condition. Where narrow frame doors are used, a 10-inch (254 mm) high smooth panel shall be installed on the push side of the door, which will allow the door to be opened by a wheelchair footrest without creating a trap or hazardous condition.

**1113A.6 Gratings.** Walks, sidewalks and pedestrian ways on an accessible route shall be free of gratings whenever possible. Gratings located in the surface of any of these areas, grid openings in gratings shall be limited to  $\frac{1}{2}$  inch (12.7 mm) in the direction of traffic flow.

**Exceptions:**

1. Where the enforcement agency determines that compliance with this section would create an unreasonable hardship, an exception may be granted when equivalent facilitation is provided.
2. This section shall not apply in those conditions where, due to legal or physical constraints, all or portions of the site of the project will not allow compliance with these building standards or equivalent facilitation on all or portions of one site without creating an unreasonable hardship.

## SECTION 1114A EXTERIOR RAMPS AND LANDINGS ON ACCESSIBLE ROUTES

**1114A.1 Width.** The width of ramps shall be consistent with the requirements for exits in Chapter 10 of this code, but in no case shall the ramp width be less than the following:

1. Ramps serving accessible entrances to covered multi-family buildings where the ramp is the only exit discharge path and serves an occupant load of 300 or more shall have a minimum clear width of 60 inches (1524 mm).
2. Ramps serving accessible entrances of covered multi-family dwellings with an occupant load of 10 or less may be 36 inches (914 mm) in clear width.
3. All other ramps shall have a minimum clear width of 48 inches (1219 mm).

4. Handrails, curbs, wheel guides and/or appurtenances shall not project into the required clear width of a ramp.

**Note:** See Section 1114A.6.2.4 for handrail projections.

**1114A.2 Slope.** The maximum slope of ramps on an accessible route shall be no greater than 1 unit vertical in 12 units horizontal (8.33-percent slope). Transitions from ramps to walks, gutters or streets shall be flush and free of abrupt changes.

**Exception:** Ramps serving decks, patios or balconies as specified in Section 1132A.4.

**1114A.2.1 Cross slope.** The cross slope of ramp surfaces shall be no greater than  $\frac{1}{4}$  inch (6.35 mm) per foot (2.083-percent slope).

**1114A.3 Outdoor ramps.** Outdoor ramps, ramp landings and their approaches shall be designed so that water will not accumulate on the walking surface.

**1114A.4 Landings.** Ramp landings shall be level and comply with this section.

**1114A.4.1 Location of landings.** Landings shall be provided at the top and bottom of each ramp. Intermediate landings shall be provided at intervals not exceeding 30 inches (762 mm) of vertical rise and at each change of direction. Landings are not considered in determining the maximum horizontal distance of each ramp.

**Note:** Examples of ramp dimensions are:

SLOPE (Grading %)	MAXIMUM RISE (Inches)	MAXIMUM HORIZONTAL PROJECTION (Feet)
	(x 25.4 for mm)	(x 304.8 for mm)
1:12 (8.33%)	30	30
1:15 (6.67%)	30	37.5
1:16 (6.25%)	30	40
1:20 (5.00%)	30	50

**1114A.4.2 Size of top landings.** Top landings shall not be less than 60 inches (1524 mm) wide. Top landings shall have a minimum length of not less than 60 inches (1524 mm) in the direction of the ramp run. See Section 1126A.3 for maneuvering clearances at doors.

**1114A.4.3 Landing width.** The minimum width of bottom and intermediate landings shall not be less than the width of the ramp.

**1114A.4.4 Encroachment of doors.** Doors in any position shall not reduce the minimum dimension of the landing to less than 42 inches (1067 mm) and shall not reduce the required width by more than 3 inches (76.2 mm) when fully open. (See Figure 11A-6D).

**1114A.4.5 Strike edge extension.** The width of the landing shall comply with Section 1126A.3 for strike edge extension and maneuvering space at doors.

**1114A.4.6 Change of direction.** Intermediate and bottom landings at a change of direction in excess of 30 degrees shall have a length in the direction of ramp run of not less than 72 inches (1829 mm). (See Figure 11A-6C).

**1114A.4.7 Other intermediate landings.** Other intermediate landings shall have a dimension in the direction of ramp run of not less than 60 inches (1524 mm). (See Figure 11A-6C).

**1114A.5 Ramp height.** Ramps more than 30 inches (762 mm) above the adjacent floor or ground and open on one or both sides shall be provided with guardrails as required by Section 1013. Guardrails shall be continuous from the top of the ramp to the bottom of the ramp.

**1114A.6 Ramp handrails.**

**1114A.6.1 Where required.** Handrails shall be provided at each side of ramps when the slope exceeds 1 unit vertical in 20 units horizontal (5-percent slope). Handrails on all ramps shall be continuous.

**Exceptions:**

1. Curb ramps.
2. Ramps that serve an individual dwelling unit may have one handrail, except that ramps open on one or both sides shall have handrails provided on the open side or sides.
3. Ramps at exterior door landings with less than 6 inches (152 mm) rise or less than 72 inches (1829 mm) in length.

**1114A.6.2 Handrail configuration.**

**1114A.6.2.1 Handrail heights.** The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the ramp surface.

**1114A.6.2.2 Handrail ends.** Handrail ends shall be returned.

**1114A.6.2.3 Handrail extension.** Handrails shall extend a minimum of 12 inches (305 mm) beyond the top and bottom of the ramp. Where the extension creates a hazard, the termination of the extension shall be rounded or returned smoothly to floor, wall or post. (See Figure 11A-5A).

**1114A.6.2.4 Handrail projections.** Handrails projecting from a wall shall have a space of  $1\frac{1}{2}$  inches (38.1 mm) between the wall and the handrail. Handrails shall not reduce the required minimum clear width of ramps.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B).

**1114A.6.2.5 Handrail grips.** The handgrip portion of handrails shall not be less than  $1\frac{1}{4}$  inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. Edges shall have a minimum radius of  $\frac{1}{8}$  inch (3.17 mm). Handrails shall not rotate within their fittings. (See Figure 11A-6B).

**Note:** For public use areas, public accommodations, and public housing, see Chapter 11B, for provisions of the Division of the State Architect-Access Compliance (DSA-AC).

**1114A.7 Edge protection.** Ramps and ramp landings shall be provided with a continuous and uninterrupted barrier on each side along the entire length in compliance with Sections 1010.10 and 1010.10.1. (See Figure 11A-5A.)

**Note:** Extended floors or ground surfaces, as permitted in Section 1010.10.2, are not allowed for ramps and ramp landings part of an accessible route.

## SECTION 1115A EXTERIOR STAIRWAYS

**1115A.1 General.** Exterior stairways serving buildings on a site containing covered multifamily dwelling units shall comply with this section.

**1115A.2 Open risers.** Open risers are not permitted on exterior stairways.

**Exceptions:**

1. An opening of not more than  $\frac{1}{2}$  inch (12.7 mm) may be permitted between the base of the riser and the tread.
2. Risers constructed of grating containing openings of not more than  $\frac{1}{2}$  inch (12.7 mm) may be permitted.

**1115A.3 Treads.** All tread surfaces shall be slip resistant. Threads shall have smooth, rounded or chamfered exposed edges, and no abrupt edges at the nosing (lower front edge).

**1115A.4 Nosing.** Nosing shall not project more than  $1\frac{1}{4}$  inches (31.8 mm) past the face of the riser below. Risers shall be sloped or the underside of the nosing shall have an angle not more than 30 degrees (0.52 rad) from the vertical. (See Figure 11A-6A).

**1115A.5 Striping for the visually impaired.** Exterior stairs serving buildings on a site containing multifamily dwelling units shall have the upper approach and all treads marked by a stripe providing clear visual contrast.

The stripe shall be a minimum of 2 inches (50.8 mm) wide to a maximum of 4 inches (101.6 mm) wide placed parallel to, and not more than 1 inch (25.4 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable.

**1115A.6 Exterior stairway handrails.**

**1115A.6.1 Where required.** Stairways shall have handrails on each side. Intermediate handrails shall be located equidistant from the sides of the stairway and comply with Section 1012.9.

**Exception:** Stairways serving an individual dwelling unit may have one handrail, except that stairways open on one or both sides shall have handrails on the open side or sides.

**1115A.6.2 Handrail configuration.**

**1115A.6.2.1 Handrail heights.** The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the nosing of the treads.

**1115A.6.2.2 Handrail ends.** Ends shall be returned or shall terminate in newel posts or safety terminals.

**1115A.6.2.3 Handrail extension.** Handrails shall extend a minimum of 12 inches (305 mm) beyond the top nosing and 12 inches (305 mm), plus the tread width, beyond the bottom nosing.

Where the extension creates a hazard, the termination of the extension shall be rounded or returned smoothly to floor, wall or post. Where the stairs are continuous from landing to landing, the inner rail shall be continuous and need not extend out into the landing. (See Figures 11A-6A and 11A-6E).

**1115A.6.2.4 Handrail projections.** Handrails projecting from a wall shall have a space of  $1\frac{1}{2}$  inches (38.1 mm) between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B).

**1115A.6.2.5 Handrail grips.** The handgrip portion of handrails shall not be less than  $1\frac{1}{4}$  inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. Edges shall have a minimum radius of  $\frac{1}{8}$  inch (3.17 mm). Handrails shall not rotate within their fittings. (See Figure 11A-6B).

**Note:** For public use areas, public accommodations, and public housing, see Chapter 11B, for provisions of the Division of the State Architect-Access Compliance (DSA-AC).

## SECTION 1116A HAZARDS ON ACCESSIBLE ROUTES

**1116A.1 Warning curbs.** Abrupt changes in level exceeding 4 inches (101.6 mm) in vertical dimension, such as changes in level at planters or fountains located in or adjacent to walks, sidewalks or other pedestrian ways shall be identified by curbs or other approved barriers projecting at least 6 inches (152.4 mm) in height above the walk or sidewalk surface to warn the blind of a potential drop-off.

### Exceptions:

1. Between a walk or sidewalk and an adjacent street or driveway.
2. When a guardrail or handrail is provided with edge protection in accordance with Section 1010.10.1.

**1116A.2 Headroom clearance.** Walks, pedestrian ways, and other circulation spaces, which are part of the required egress system, shall have a minimum clear headroom as required in Section 1003.2. Other walks, pedestrian ways, and circulation spaces shall have a minimum clear headroom of 80 inches (2032 mm). If the vertical clearance of an area adjoining an accessible route is reduced to less than 80 inches (2032 mm) nominal dimension, a guardrail or other barrier having its leading edge at or below 27 inches (686 mm) above the finished floor shall be provided.

**Exception:** Doorways and archways less than 24 inches (610 mm) in depth may have a minimum clear headroom of 80 inches (2032 mm) nominal. (See Section 1126A.)

**1116A.3 Overhanging obstructions.** Any obstruction that overhangs a pedestrian way shall be a minimum of 80 inches (2032 mm) above the walking surface as measured from the bottom of the obstruction. (See Figure 11A-1B.) Where a guy support is used parallel to a path of travel, including, but not limited to, sidewalks, a guy brace, sidewalk guy or similar device shall be used to prevent an overhanging obstruction (see Section 1116A.2 for required headroom clearance).

**1116A.4 Free-standing signs.** Wherever signs mounted on posts or pylons protrude from the post or pylons and the bottom edge of the sign is less than 80 inches (2032 mm) above the finished floor or ground level, the edges of such signs shall be rounded or eased and the corners shall have a minimum radius of 0.125 inches (see Section 1116A.2 for required headroom clearance).

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**SECTION 1117A  
GENERAL REQUIREMENTS FOR ACCESSIBLE  
ENTRANCES, EXITS, INTERIOR ROUTES OF  
TRAVEL AND FACILITY ACCESSIBILITY**

**Note:** In addition to provisions of this division, interior routes of travel that provide access to, or egress from, buildings for persons with disabilities shall also comply with Chapter 10.

**1117A.1 General.** When buildings are required to be accessible, building facilities shall be accessible as provided in this division. Where specific floors of a building are required to be accessible, the requirements of this division shall apply only to the facilities located on accessible floors.

**1117A.2 Primary entrances and exterior exit doors.** All primary entrances and exterior ground floor exit doors to buildings and facilities on accessible routes shall be accessible to persons with disabilities.

**1117A.3 Separate dwelling unit entrances.** When a ground-floor dwelling unit of a building has a separate entrance, each such ground-floor dwelling unit shall be served by an accessible route, except where the terrain or unusual characteristics of the site prohibit an accessible route (see Section 1150A for site impracticality tests).

**1117A.4 Multiple entrances.** Only one entrance to covered multifamily buildings is required to be accessible to any one ground floor of a building, except in cases where an individual dwelling unit has a separate exterior entrance. Where the building contains clusters of dwelling units with each cluster sharing a different exterior entrance, more than one entrance may be required to be accessible, as determined by analysis of the site. In every case, the accessible entrance shall be on an accessible route to the covered dwelling units it serves.

**SECTION 1118A  
EGRESS AND AREAS OF REFUGE**

**1118A.1 General.** Including but not limited to the requirements contained in this chapter for accessible routes, signage and emergency warning systems in buildings or portions of buildings required to be accessible shall be provided with accessible means of egress as required by Chapter 10. (See Section 1007.)

**SECTION 1119A  
INTERIOR ROUTES OF TRAVEL**

**1119A.1 General.** When a building or portion of a building is required to be accessible or adaptable, an accessible route shall be provided to all portions of the building, accessible building entrances and to covered multifamily dwelling units. The accessible route shall, to the maximum extent feasible, coincide with the route for the general public and other building residents. Accessible routes shall not pass through kitchens, storage rooms, restrooms, closets or other spaces used for similar purposes except within an individual dwelling unit. Accessible routes shall be provided as follows:

1. Where more than one route of travel is provided, all routes shall be accessible.
2. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces, elements and covered multifamily dwelling units.
3. An accessible route shall connect at least one accessible primary entrance of each covered multifamily dwelling unit with interior and exterior spaces and facilities that serve the unit.
4. Where elevators are provided for vertical access, all elevators shall be accessible.

**1119A.2 Flooring.** Floor and ground surfaces shall be stable, firm, and slip resistant. If carpet or carpet tile is used in a common use area or public use area on a ground or floor surface, it shall have firm backing or no backing. Carpet or carpet tile shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. The maximum pile height shall be  $\frac{1}{2}$  inch (12.7 mm). Exposed edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with Section 1121A requirements for changes in level.

**1119A.2.1 Recessed doormats.** Recessed doormats shall be adequately anchored to prevent interference with wheelchair traffic.

**SECTION 1120A  
INTERIOR ACCESSIBLE ROUTES**

**Note:** For the purpose of this section, interior accessible routes shall include but not be limited to corridors, hallways, exit balconies and covered or enclosed walkways.

**1120A.1 Widths.** Interior accessible routes serving an occupant load of 10 or more shall not be less than 44 inches (1118 mm) in width. Interior accessible routes serving an occupant load of less than 10 shall not be less than 36 inches (914 mm) in width.

If a person in a wheelchair must make a turn around a corner or an obstruction, the minimum clear width of the accessible route shall be as specified in Section 1138A.1.5.

**1120A.2 Interior accessible routes over 200 feet.** Interior accessible routes that exceed 200 feet (60 960 mm) in length shall comply with Section 1138A.1.2. See Figure 11A-1L.

**1120A.3 Changes in elevation.** Interior accessible routes which have changes in elevation shall be transitioned and comply with Section 1121A or 1122A.

**Exception:** Doors and thresholds as provided in Section 1126A.

### SECTION 1121A CHANGES IN LEVEL ON ACCESSIBLE ROUTES

**1121A.1 Changes in level not exceeding  $\frac{1}{2}$  inch.** Abrupt changes in level along any accessible route shall not exceed  $\frac{1}{2}$  inch (12.7 mm). When changes in level do occur, they shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level not exceeding  $\frac{1}{4}$  inch (6.35 mm) may be vertical.

**1121A.2 Changes greater than  $\frac{1}{2}$  inch.** Changes in level greater than  $\frac{1}{2}$  inch (12.7 mm) shall be made by means of a sloped surface not greater than 1 unit vertical in 20 units horizontal (5-percent slope), or a curb ramp, ramp, elevator or platform (wheelchair) lift. Stairs shall not be part of an accessible route. When stairs are located along or adjacent to an accessible route they shall comply with Section 1123A for interior stairways.

### SECTION 1122A INTERIOR RAMPS AND LANDINGS ON ACCESSIBLE ROUTES

**1122A.1 Width.** The width of ramps shall be consistent with the requirements for exits in Chapter 10 of this code, but in no case shall the ramp width be less than the following:

1. Ramps serving accessible entrances to covered multi-family buildings where the ramp is the only exit discharge path and serves an occupant load of 300 or more shall have a minimum clear width of 60 inches (1524 mm).
2. Ramps serving accessible entrances to covered multi-family dwellings with an occupant load of 10 or less may be 36 inches (914 mm) in clear width.
3. All other ramps shall have a minimum clear width of 48 inches (1219 mm).
4. Handrails, curbs, wheel guides and/or appurtenances shall not project into the required clear width of a ramp.

**Note:** See Section 1122A.5.2.4 for handrail projections.

**1122A.2 Slope.** The maximum slope of ramps on an accessible route shall be no greater than 1 unit vertical in 12 units horizontal (8.33-percent slope).

**1122A.2.1 Cross slope.** The cross slope of ramp surfaces shall not exceed  $\frac{1}{4}$  inch (6.35 mm) per foot (2.083-percent slope).

**1122A.3 Landings.** Ramp landings shall be level and comply with this section.

**1122A.3.1 Location of landings.** Landings shall be provided at the top and bottom of each ramp. Intermediate landings shall be provided at intervals not exceeding 30 inches (762 mm) of vertical rise and at each change of direction. Landings are not considered in determining the maximum horizontal distance of each ramp.

**Note:** Examples of ramp dimensions are:

SLOPE (Grading %)	MAXIMUM RISE (Inches)	MAXIMUM HORIZONTAL PROJECTION (Feet)
	(x 25.4 for mm)	(x 304.8 for mm)
1:12 (8.33%)	30	30
1:15 (6.67%)	30	37.5
1:16 (6.25%)	30	40
1:20 (5.00%)	30	50

**1122A.3.2 Size of top landings.** Top landings shall not be less than 60 inches (1524 mm) wide. Top landings shall have a minimum length of not less than 60 inches (1524 mm) in the direction of the ramp run. See Section 1126A.3 for maneuvering clearances at doors. (See Figure 11A-6C.)

**1122A.3.3 Landing width.** The minimum width of bottom and intermediate landings shall not be less than the width of the ramp.

**1122A.3.4 Encroachment of doors.** Doors in any position shall not reduce the minimum dimension of the landing to less than 42 inches (1067 mm) and shall not reduce the required width by more than 3 inches (76.2 mm) when fully open. (See Figure 11A-6D.)

**1122A.3.5 Strike edge extension.** The width of the landing shall comply with Section 1126A.3 for maneuvering clearances at doors.

**1122A.3.6 Change of direction.** Intermediate and bottom landings at a change of direction in excess of 30 degrees shall have a length in the direction of ramp run of not less than 72 inches (1829 mm). (See Figures 11A-6C and 11A-6D.)

**1122A.3.7 Other intermediate landings.** Other intermediate landings shall have a dimension in the direction of ramp run of not less than 60 inches (1524 mm). (See Figure 11A-6C.)

**1122A.4 Ramp height.** Ramps more than 30 inches (762 mm) above the adjacent floor or ground and open on one or both sides shall be provided with a guard as required by Section 1013. Guardrails shall be continuous from the top of the ramp to the bottom of the ramp.

**1122A.5 Ramp handrails.**



**1122A.5.1 Where required.** Handrails shall be provided at each side of ramps when the slope exceeds 1 unit vertical in 20 units horizontal (5-percent slope). Handrails on all ramps shall be continuous.

**Exceptions:**

1. Curb ramps.
2. Ramps that serve an individual dwelling unit may have one handrail, except that ramps open on one or both sides shall have handrails provided on the open side or sides.

**1122A.5.2 Handrail configuration.**

**1122A.5.2.1 Handrail heights.** The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the ramp surface.

**1122A.5.2.2 Handrail ends.** Handrail ends shall be returned.

**1122A.5.2.3 Handrail extension.** Handrails shall extend a minimum of 12 inches (305 mm) beyond the top and bottom of the ramp. Where the extension creates a hazard, the termination of the extension shall be rounded or returned smoothly to floor, wall or post. (See Figure 11A-5A.)

**1122A.5.2.4 Handrail projections.** Handrails projecting from a wall shall have a space of  $1\frac{1}{2}$  inches (38.1 mm) between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B.)

**1122A.5.2.5 Handrail grips.** The handgrip portion of handrails shall not be less than  $1\frac{1}{4}$  inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. Edges shall have a minimum radius of  $\frac{1}{8}$  inch (3.17 mm). Handrails shall not rotate within their fittings. (See Figure 11A-6B.)

**Note:** For public use areas, public accommodations, and public housing, see Chapter 11B for provisions of the Division of the State Architect-Access Compliance (DSA-AC).

**1122A.6 Edge protection.** Ramps and ramp landings shall be provided with a continuous and uninterrupted barrier on each side along the entire length in compliance with Sections 1010.10 and 1010.10.1. (See Figure 11A-5A.)

**Note:** Extended floors or ground surfaces, as permitted in Section 1010.10.2, are not allowed for ramps and ramp landings providing access to, or egress from, buildings or facilities where accessibility is required.

## SECTION 1123A INTERIOR STAIRWAYS

**1123A.1 General.** Interior stairways serving buildings containing covered multifamily dwelling units shall comply with this section.

**1123A.2 Open risers.** Open risers shall not be permitted on interior stairways.

**Exception:** Stairways within an individual dwelling unit.

**1123A.3 Treads.** All tread surfaces shall be slip resistant. Treads shall have smooth, rounded or chamfered exposed edges and no abrupt edges at the nosing (lower front edge).

**1123A.4 Nosing.** Nosing shall not project more than  $1\frac{1}{4}$  inches (31.8 mm) past the face of the riser below. Risers shall be sloped or the underside of the nosing shall have an angle not more than 30 degrees (0.52 rad) from the vertical. (See Figure 11A-6A)

**1123A.5 Striping for the visually impaired.** Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast.

**Exception:** Stairways within an individual dwelling unit.

The stripe shall be a minimum of 2 inches (50.8 mm) wide to a maximum of 4 inches (101.6 mm) wide placed parallel to, and not more than 1 inch (25.4 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable.

**1123A.6 Interior stairway handrails.**

**1123A.6.1 Where required.** Stairways shall have handrails on each side. Intermediate handrails shall be located equidistant from the sides of the stairway and comply with Section 1012.9.

**Exception:** Stairways serving an individual dwelling unit may have one handrail, except that stairways open on one or both sides shall have handrails on the open side or sides.

**1123A.6.2 Handrail configuration.**

**1123A.6.2.1 Handrail heights.** The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the nosing of the treads.

**1123A.6.2.2 Handrail ends.** Ends shall be returned or shall terminate in newel posts or safety terminals.

**1123A.6.2.3 Handrail extension.** Handrails shall extend a minimum of 12 inches (305 mm) beyond the top nosing and 12 inches (305 mm), plus the tread width, beyond the bottom nosing. Where the extension creates a hazard, the termination of the extension shall be rounded or returned smoothly to floor, wall or post. Where the stairs are continuous from landing to landing, the inner rail shall be continuous and need not extend out into the landing. (See Figures 11A-6A and 11A-6E).

**Exception:** Stairways within an individual dwelling unit.

**1123A.6.2.4 Handrail projections.** Handrails projecting from a wall shall have a space of  $1\frac{1}{2}$  inches (38.1 mm) between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B).

**1123A.6.2.5 Handrail grips.** The handgrip portion of handrails shall not be less than  $1\frac{1}{4}$  inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. Edges shall have a minimum radius of  $\frac{1}{8}$  inch (3.17 mm). Handrails shall not rotate within their fittings. (See Figure 11A-6B).

**Note:** For public use areas, public accommodations, and public housing, see Chapter 11B for provisions of the Division of the State Architect-Access Compliance (DSA-AC).

## SECTION 1124A ELEVATORS AND PLATFORM (WHEELCHAIR) LIFTS

**1124A.1 General.** Elevators provided in covered multifamily buildings shall be accessible. Elevators required to be accessible shall comply with this chapter, ASME A17.1, Safety Code for Elevators and Escalators, Title 8, of the California Code of Regulations, under "Elevator Safety Orders," and any other applicable safety regulations of other administrative authorities having jurisdiction.

**Exception:** Private elevators serving only one dwelling unit.

**1124A.2 Location.** Passenger elevators shall be located on a major accessible route and provisions shall be made to ensure that they remain accessible and usable at all times that the building is occupied.

### 1124A.3 Size of cab and control locations.

**1124A.3.1 General.** Elevators serving covered multifamily buildings shall be sized to accommodate a wheelchair in accordance with this section.

**Exception:** When the enforcing agency determines that compliance with any requirement of this section would create an unreasonable hardship, an exception to the requirement shall be granted when equivalent facilitation is provided, and where it can be demonstrated that a person using a wheelchair can enter and operate the elevator.

**1124A.3.2 Car inside.** The car inside shall allow for the turning of a wheelchair. The minimum clear distance between walls or between wall and door, excluding return panels, shall not be less than 80 inches by 54 inches (2032 mm by 1372 mm) for center-opening doors, and 68 inches by 54 inches (1727 mm by 1372 mm) for side-slide open-

ing doors. (See Figure 11A-7A). Minimum distance from wall to return panel shall not be less than 51 inches (1295 mm).

**1124A.3.2.1 Door size.** Elevator doors shall provide a minimum clear width of 36 inches (914 mm).

### 1124A.3.3 Car controls.

**1124A.3.3.1 Car control location.** Elevator floor buttons shall be within 54 inches (1372 mm) above the finish floor for side approach and 48 inches (1219 mm) for front approach. Except for photoelectric tube bypass switches, emergency controls, including the emergency stop and alarm, shall be grouped in or adjacent to the bottom of the panel and shall be no lower than 35 inches (889 mm) from the floor. For multiple controls only, one set must comply with these height requirements. Floor buttons shall be provided with visual indicators to show when each call is registered. The visual indicators shall be extinguished when each call is answered.

**Note:** Where possible, a 48-inch (1219 mm) maximum height for elevator floor buttons is preferred.

**1124A.3.3.2 Car control buttons.** Passenger elevator car controls shall have a minimum dimension of  $\frac{3}{4}$  inch (19.1 mm) and shall be raised  $\frac{1}{8}$  inch (3.2 mm) plus or minus  $\frac{1}{32}$  inch (0.8 mm) above the surrounding surface.

Control buttons shall be illuminated, shall have square shoulders and shall be activated by a mechanical motion that is detectable.

All control buttons shall be designated by a  $\frac{5}{8}$ -inch-minimum (15.9 mm) raised characters and standard raised symbols that comply with Sections 1143A.6 and 1143A.7 immediately to the left of the control button. Contracted Grade 2 Braille that conforms to Section 1143A.7 shall be located immediately below the numeral, character or symbol. A minimum clear space of  $\frac{3}{8}$  inch (9.5 mm) or other suitable means of separation shall be provided between rows of control buttons. (See Figure 11A-7B.)

The raised characters and symbols shall be white on a black background. Controls and emergency equipment identified by raised symbols shall include, but not be limited to, "door open," "door close," "alarm bell," "emergency stop" and "telephone." The call button for the main entry floor shall be designated by a raised star at the left of the floor designation.

**1124A.3.4 Emergency telephone.** The emergency telephone handset shall be positioned no higher than 48 inches (1219 mm) above the floor, and the handset cord shall be a minimum of 29 inches (737 mm) in length. If the telephone system is located in a closed compartment, the compartment door hardware shall conform to the provisions of Section 1138A.4.4. Emergency intercommunication shall not require voice communication.

**1124A.4 Hall call buttons.** Call operation buttons shall be centered 42 inches (1067 mm) above the floor. Buttons shall be a minimum of  $\frac{3}{4}$ -inch (19.1 mm) in size and shall be raised  $\frac{1}{8}$ -inch (3.2 mm) plus or minus  $\frac{1}{32}$ -inch (0.8 mm) above the

surrounding surface. The button designating the “up” direction shall be on top.

Visual indication shall be provided to show each call registered and extinguished when answered. Objects adjacent to, and below, hall call buttons shall not project more than 4 inches (101.6 mm) from the wall. Hall call buttons shall be internally illuminated with a white light over the entire surface of the button.

**1124A.5 Minimum illumination.** The minimum illumination at the car controls threshold and the landing when the car and landing doors are open shall not be less than 5 foot-candles (54 lx).

**1124A.6 Hall lantern.** A visual and audible signal shall be provided at each hoistway entrance indicating to the prospective passenger the car answering the call and its direction of travel as follows:

1. The visual signal for each direction shall be a minimum of  $2\frac{1}{2}$  inches (63.5 mm) high by  $2\frac{1}{2}$  inches (63.5 mm) wide, and visible from the proximity of the hall call button.
2. The audible signal shall sound once for the “up” direction and twice for the “down” direction or of a configuration which distinguishes between up and down elevator travel.
3. The center line of the fixture shall be located a minimum of 6 feet (1829 mm) in height from the lobby floor.
4. The use of in-car lanterns, located in or on the car doorjamb, visible from the proximity of the hall call buttons and conforming to the above requirements of this section shall or will be acceptable.

**Note:** The use of arrow shapes are preferred for visible signals.

#### **1124A.7 Door delay.**

**1124A.7.1 Hall call.** The minimum acceptable time from notification that a car is answering a call (lantern and audible signal) until the doors of the car start to close shall be calculated by the following equations but shall be no less than 5 seconds:

$$T = D / (1.5 \text{ ft/s}) \text{ or } T = D / (445 \text{ mm/s})$$

Where  $T$  is the total time in seconds and  $D$  is the distance from a point in the lobby or landing area 60 inches (1524 mm) directly in front of the farthest call button controlling that car to the centerline of its hoistway door (see Figure 11A-7D). For cars with in-car lanterns,  $T$  begins when the lantern is visible from the vicinity of hall call buttons and an audible signal is sounded.

**1124A.7.2 Door delay for car calls.** The minimum acceptable time for the door to remain fully open after receiving a call shall not be less than 5 seconds.

**1124A.8 Doorjamb marking.** The floor level at all elevator hoistway entrances shall be designated by raised characters provided on both jambs. Characters shall be 2 inches (50.8 mm) in height located with the centerline 60 inches (1524 mm) from the floor. On the main entry level, a raised five-pointed star shall be placed to the left of the raised character.

The outside diameter of the star shall be 2 inches (50.8 mm) and all points shall be of equal length. The raised characters and the star shall be white on a black background. Contracted Grade 2 Braille, conforming to Section 1143A.7, shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall state “MAIN”. The raised characters shall comply with Section 1143A.6. (See Figure 11A-7C.)

**1124A.9 Door protective and reopening devices.** Doors closed by automatic means shall be provided with a door-reopening device that will function to stop and reopen a car door and adjacent hoistway door in case the car door is obstructed while closing.

This reopening device shall also be capable of sensing an object or person in the path of a closing door without requiring contact for activation at a nominal 5 inches and 29 inches (127 mm and 737 mm) above the floor.

Door-reopening devices shall remain effective for a period of not less than 20 seconds. After such an interval, the doors may close in accordance with the requirements of ASME A17.1.

**1124A.10 Operation and leveling.** The elevator shall be automatic and be provided with a self-leveling feature that will automatically bring the car to the floor landings within a tolerance of plus or minus  $\frac{1}{2}$  inch (12.7 mm) under rated loading to zero loading conditions. This self-leveling shall, within its zone, be entirely automatic and independent of the operating device and shall correct the overtravel or undertravel. The car shall also be maintained approximately level with the landing, irrespective of load.

The clearance between the car platform sill and the edge of the hoistway landing shall be no greater than  $1\frac{1}{4}$  inches (31.75 mm).

#### **1124A.11 Platform (wheelchair) lifts.**

**1124A.11.1 General.** Platform (wheelchair) lifts may be provided between levels, in lieu of passenger elevators, when the vertical distance between landings, as well as the structural design and safeguards are as allowed by ASME A18.1, “Safety Standard for Platform Lifts and Stairway Chair Lifts;” the State of California, Department of Industrial Relations, Division of Occupational Safety and Health (Title 8 “Elevator Safety Orders”) and any applicable safety regulations of other administrative authorities having jurisdiction.

If lifts are provided, they shall be designed and constructed to facilitate unassisted entry, operation and exit from the lift, and shall comply with restrictions and enhancements of this section in conjunction with Title 8 of the California Code of Regulations.

**1124A.11.2 Size and clear floor space.** Platform (wheelchair) lifts shall be of sufficient size to accommodate a wheelchair in accordance with Section 1138A.1.4.

**1124A.11.3 Lift access.** There shall be a level and clear floor area or landing at each floor or level served by platform (wheelchair) lifts. Clear floor areas or landings shall meet the applicable “accessible route” requirements.

**1124A.11.4 Standby power.** To ensure continued operation in case of primary power loss, platform (wheelchair) lifts shall be provided with standby power or with self-rechargeable battery power that provides sufficient power to operate all platform lift functions for a minimum of five upward and downward trips.

**1124A.11.5 Openness.** Platform (wheelchair) lifts on an accessible means of egress shall not be installed in a fully enclosed hoistway.

**1124A.11.6 Doors and gates.** Lifts shall have low energy power-operated doors or gates, which shall remain open for 20 seconds minimum. End doors shall have 32 inches (813 mm) minimum clear opening width. Side doors clear opening width shall be 42 inches (1067 mm) minimum.

**Exception:** Lifts having doors or gates on opposite sides shall be permitted to have self-closing manual doors or gates.

**1124A.11.7 Restriction sign.** A sign complying with Section 1143A shall be securely fastened in a conspicuous place at each landing and on the platform. The sign shall state "No Freight" in letters not less than 5/8 inch (16 mm) high and include the International Symbol of Accessibility.

## SECTION 1125A HAZARDS ON ACCESSIBLE ROUTES

**1125A.1 Warning curbs.** Abrupt changes in level exceeding 4 inches (101.6 mm) in vertical dimension, such as changes in level at planters or fountains located in or adjacent to walks, halls, corridors, passageways, aisles, pedestrian ways and other circulation spaces shall be identified by curbs projecting at least 6 inches (152.4 mm) in height above the walk or sidewalk surface to warn the blind of a potential drop-off.

**Exception:** When a guardrail or handrail is provided with edge protection in accordance with Section 1010.10.1.

**1125A.2 Headroom clearance.** Walks, halls, corridors, passageways, aisles, pedestrian ways and other circulation spaces which are part of the required egress system shall have a minimum clear headroom as required in Section 1003.2. Other walks, pedestrian ways and circulation spaces shall have a minimum clear headroom of 80 inches (2032 mm). If the vertical clearance of an area adjoining an accessible route is reduced to less than 80 inches (2032 mm) nominal dimension, a guardrail or other barrier having its leading edge at or below 27 inches (686 mm) above the finished floor shall be provided.

**Exception:** Doorways and archways less than 24 inches (610 mm) in depth may have a minimum clear headroom of 80 inches (2032 mm) nominal. (See Section 1126A.)

**1125A.3 Overhanging obstructions.** Any obstruction that overhangs a pedestrian way shall be a minimum of 80 inches (2032 mm) above the walking surface as measured from the bottom of the obstruction. (See Figure 11A-1B.) Where a guy support is used parallel to a path of travel, including, but not

limited to, sidewalks, a guy brace, sidewalk guy or similar device shall be used to prevent an overhanging obstruction (see Section 1125A.2 for required headroom clearance).

**1125A.4 Free-standing signs.** Wherever signs mounted on posts or pylons protrude from the posts or pylons and the bottom edge of the sign is less than 80 inches (2032 mm) above the finished floor or ground level, the edges of such signs shall be rounded or eased and the corners shall have a minimum radius of 0.125 inches. (See Section 1125A.2 for required headroom clearance).

## SECTION 1126A DOORS

**1126A.1 Width and height of doors.** Doorways which provide access to common use areas or covered multifamily dwellings shall comply with the following:

1. Permit the installation of a door not less than 36 inches (914 mm) in width, not less than 80 inches (2032 mm) in height and provide a clear width of not less than 32 inches (813 mm), measured with the door positioned at an angle of 90 degrees from its closed position.
2. Be capable of opening at least 90 degrees.
3. A pair of doors, manual or automatic, must have at least one leaf which provides a clear width of not less than 32 inches (813 mm), measured with the door positioned at an angle of 90 degrees from its closed position.
4. The width of any component in the egress system shall not be less than the minimum width required by Section 1005.

Revolving doors shall not be used as required entrances for persons with disabilities.

**1126A.2 Level floor or landing.** The floor or landing on each side of an exit door shall be level. (See Chapter 10).

**1126A.2.1 Thresholds and changes in elevation at doors.** The floor or landing shall not be more than 1/2 inch (12.7 mm) lower than the top of the threshold of the doorway. (See Figure 11A-8I).

Changes in level between 1/4 inch (6.35 mm) and 1/2 inch (12.7 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50% slope). Changes in level greater than 1/2 inch (12.7 mm) shall be accomplished by means of a ramp (see Section 1122A).

**1126A.3 Maneuvering clearances at doors.**

**1126A.3.1 General.** The level floor or landing of an exit door shall have a length in the direction of the door swing of at least 60 inches (1524 mm) and a length opposite the direction of the door swing of at least 44 inches (1118 mm) measured at right angles to the plane of the door in its closed position. (See Figures 11A-8D, 11A-8E and 11A-8F for maneuvering spaces at sliding doors).

**1126A.3.2 Strike edge maneuvering space.** The width of the level area on the side to which the door swings shall

extend at least 24 inches (610 mm) past the strike edge of the door for exterior doors and at least 18 inches (457 mm) past the strike edge for interior doors.

**Note:** Twenty-four inches (610 mm) is preferred for strike-side clearance.

**1126A.3.2.1 Front approach.** The following provisions shall apply to swinging doors with front approach:

1. For pull side approach, the level floor or landing shall extend in the direction of the door swing at least 60 inches (1524 mm). (See Figure 11A-8A).
2. For push side approach, the level floor or landing shall extend opposite the direction of the door swing at least 48 inches (1219 mm). (See Figure 11A-8A).
3. Doors with push side approach having both a closer and a latch shall be provided with a clear and level area extending a minimum of 12 inches (305 mm) past the strike edge on the approach side of the door. (See Figure 11A-8A).

**1126A.3.2.2 Hinge side approach.** The following provisions shall apply to swinging doors with hinge side approach:

1. Doors with pull side approach shall be provided with a level floor or landing not less than 60 inches (1524 mm) in depth. A clear and level area shall extend a minimum of 36 inches (914 mm) past the strike edge on the approach side of the door. (See Figure 11A-8B).

**Exception:** Doors with pull side approach and a level floor or landing greater than 60 inches (1524 mm) in depth shall be provided with a clear and level area at least 24 inches (610 mm) past the strike edge of the door for exterior doors and at least 18 inches (457 mm) past the strike edge for interior doors.

2. Doors with push side approach shall have a level floor or landing not less than 44 inches (1118 mm) in depth, and shall be provided with a clear and level area extending a minimum of 54 inches (1372 mm) from the strike edge of the door jamb past the hinge side of the door. Doors with a latch and closer shall have a level floor or landing not less than 48 inches (1219 mm) depth at the push side of the door. (See Figure 11A-8B).

**1126A.3.2.3 Latch side approach.** The following provisions shall apply to swinging doors with latch side approach:

1. Doors with pull side approach shall have a level floor or landing not less than 60 inches (1524 mm) in depth, and shall be provided with a clear and level area extending a minimum of 24 inches (610 mm) past the strike edge on the approach side of the door. (See Figure 11A-8C).

**Exception:** Doors serving individual covered multifamily dwelling units shall have a minimum landing depth of 44 inches (1118 mm)

except that doors with a closer shall have a minimum landing depth of 54 inches (1372 mm).

2. Doors with push side approach shall have a level floor or landing not less than 44 inches (1118 mm) in depth, and shall be provided with a clear and level area extending a minimum of 24 inches (610 mm) past the strike edge on the approach side of the door. Doors with a closer shall have a level floor or landing not less than 48 inches (1219 mm) depth at the push side of the door. (See Figure 11A-8C).

**1126A.3.3 Space between consecutive doors.** The minimum space between two hinged or pivoted doors in series, serving other than a required exit stairway, shall provide a minimum of 48 inches (1219 mm) plus the width of the door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors. (See Figures 11A-8G and 11A-8H).

Where the door opens into a stair or smokeproof enclosure, the landing need not have a minimum length of 60 inches (1524 mm). (See Figure 11A-8H).

**1126A.4 Closer-effort to operate doors.** Maximum effort to operate doors shall not exceed 8½ pounds (38 N) for exterior doors and 5 pounds (22 N) for interior doors, such pull or push effort being applied at right angles to hinged doors and at the center plane of sliding or folding doors. Compensating devices or automatic door operators may be utilized to meet these standards. When fire doors are required, the maximum effort to operate the door may be increased to the minimum allowable by the appropriate enforcement agency, not to exceed 15 pounds (66.7 N).

**1126A.4.1 Door closer.** If the door has a closer, then the sweep period of the closer shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the landing edge of the door.

**1126A.5 Type of lock or latch.** The type of latch and lock required for all doors shall be in accordance with Section 1126A.6 and Chapter 10, Section 1008.

**1126A.6 Hand-activated door hardware.** Hand-activated door latching, locking and opening hardware shall be centered between 30 inches (762 mm) and 44 inches (1118 mm) above the floor. Latching and locking doors that are hand-activated and on an accessible route shall be operable with a single effort by lever type hardware, panic bars, push-pull activating bars or other hardware designed to provide passage without requiring the ability to grasp the opening hardware. Locked exit doors shall operate consistent with Section 1126A.4, in the direction of egress.

**1126A.6.1 Lever type hardware.** The lever or lever of actuated latches or locks shall be curved with a return to within ½ inch (12.7 mm) of the door to prevent catching on the clothing of persons during egress.

**Exception:** Group R and U occupancies with an occupant load of 10 or less.

**1126A.7 Smooth surface.** The bottom 10 inches (254 mm) of all doors and/or gates shall have a smooth, uninterrupted

surface to allow the door or gate to be opened by a wheelchair footrest without creating a trap or hazardous condition. Where narrow frame doors are used, a 10-inch high (254 mm) smooth panel shall be installed on the push side of the door, which will allow the door to be opened by a wheelchair footrest without creating a trap or hazardous condition.

**Exception:** Automatic and sliding doors or gates.

## SECTION 1127A COMMON USE FACILITIES

**Note:** For public use facilities, see Chapter 11B of this code.

**1127A.1 General.** When provided, common use areas and facilities in covered multifamily housing developments shall be accessible to persons with disabilities. Common use facilities include, but are not limited to, lobbies, toilet and bathing facilities, laundry facilities, community rooms, clubhouses, health and fitness facilities, game rooms and portions of common use tenant storage. All entrances, doors, fixtures and controls shall be on an accessible route. Facilities and fixtures required to be accessible shall comply with the following provisions:

1. **Doors.** Doors to accessible bathrooms shall comply with Section 1126A. Doors shall not swing into the floor space required for any fixture.
2. **Clear floor space.** All fixtures and controls shall be on an accessible route. Clear floor spaces at fixtures and controls, the accessible route and the turning space may overlap. This clear space shall comply with Sections 1138A.1.4 and 1138A.3.
3. **Water closets.** Where a toilet stall is provided, it shall comply with Section 1127A.2.1 or 1127A.2.2, and its water closet shall comply with Section 1127A.2.3.
4. **Lavatory and mirrors.** Where a lavatory and/or mirror is provided, it shall comply with Sections 1127A.3 and/or 1127A.8.3.
5. **Controls and dispensers.** Where controls, dispensers, receptacles or other types of equipment are provided, at least one of each shall be on an accessible route and shall comply with Sections 1127A.8 and 1138A.3.
6. **Bathing and shower facilities.** Where bathtubs or showers are provided, at least one fixture of each type provided shall be accessible per room. For bathtubs, see Section 1127A.5.2. For shower compartments, see Section 1127A.5.3.
7. **Toilet facilities.** Toilet facilities shall comply with Section 1127A.2.
8. **Laundry facilities.** Laundry facilities shall comply with Section 1127A.10.
9. **Storage facilities.** Storage facilities shall comply with Section 1127A.11.
10. **Fixed or built-in seating, tables and counters.** Fixed or built-in seating, tables and counters shall comply with Section 1127A.12.

**1127A.2 Toilet facilities.** When common use toilet facilities are provided for residents or guests, at least one percent of the total number of fixtures but not less than one of each type shall comply with this section.

**1127A.2.1 Multiple-accommodation toilet facilities.** Multiple-accommodation toilet facilities shall have the following:

**Note:** (See Figures 11A-9A and 11A-9B.)

1. **Wheelchair turning space.** Turning space of sufficient size to inscribe a circle with a diameter not less than 60 inches (1524 mm) or a T-shaped space shall be provided within the toilet facility. The wheelchair turning space shall comply with Section 1138A.1.3. Other than the door to the accessible water closet compartment, a door, in any position, may encroach into this space by not more than 12 inches (305 mm).
2. **Clear space at fixtures.** Doors shall not swing into the clear floor space required for any fixture. Required clear floor space, clearance at fixtures, and turning space shall be permitted to overlap.
3. **Accessible water closet compartment.** Accessible water closet compartments shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, 56 inches (1422 mm) deep minimum for wall hung water closets and 59 inches (1499 mm) deep minimum for floor mounted water closets measured perpendicular to the rear wall. (See Figure 11A-9A(c)).

Water closet fixtures located in accessible water closet compartments shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from the side wall or partition.

In ambulatory accessible toilet compartments specified in Item 6 of this section, the water closet shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the side wall or partition. (See Figure 11A-9A (d)).

Clearance around a water closet shall be 60 inches (1524 mm) minimum measured perpendicular from the side wall and 56 inches (1422 mm) minimum measured perpendicular from the rear wall. The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures, and the turning space. No other fixtures or obstructions shall be located within the required water closet clearance.

A minimum 48 inches (1219 mm) deep and 60 inches (1524 mm) wide clear maneuvering space shall be provided in front of the water closet if the compartment has an end-opening door (facing the water closet). A minimum 60 inches (1524 mm) deep

and 60 inches (1524 mm) wide clear maneuvering space shall be provided in a compartment with the door located at the side. (See Figure 11A-9A).

4. **Grab bars.** Grab bars shall be provided on the side wall closest to the water closet and on the rear wall. Grab bars shall comply with this section and Section 1127A.4.

The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extend 54 inches (1372 mm) minimum from the rear wall. The front end of the side grab bar shall be positioned 24 inches (610 mm) minimum in front of the water closet.

The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

**Exceptions:**

1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, when wall space does not permit a length of 36 inches (914 mm) minimum due to the location of a recessed fixture adjacent to the water closet.
  2. When the enforcing agency requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.
5. **Compartment doors.** Compartment doors shall comply with the following:
- 5.1. The water closet compartment shall be equipped with a door that has an automatic-closing device, and shall have a clear, unobstructed opening width of 32 inches (813 mm) when located at the end and 34 inches (864 mm) when located at the side with the door positioned at an angle of 90 degrees from its closed position.
  - 5.2. When standard compartment doors are used, with a minimum 9-inch (228.6 mm) clearance for footrests underneath and a self-closing device, clearance at the strike edge as specified in Section 1126A.3.2 is not required.
  - 5.3. The inside and outside of the compartment door shall be equipped with a loop or U-shaped handle immediately below the latch. The latch shall be flip-over style, sliding or other hardware not requiring the user to grasp or twist.
  - 5.4. Except for door-opening widths and door swings, a clear, unobstructed access of not

less than 44 inches (1118 mm) shall be provided to water closet compartments designed for use by persons with disabilities, and the space immediately in front of a water closet compartment shall not be less than 48 inches (1219 mm) as measured at right angles to compartment door in its closed position.

6. **Ambulatory accessible compartments.** When six or more toilet compartments are provided within a multiple-accommodation toilet room, or when the combination of urinals and water closets totals six or more fixtures, at least one compartment shall comply with Section 1127A.2.1, Items 2 and 3. At least one additional ambulatory compartment shall have a depth of 60 inches (1524 mm) minimum, and a width of 35 inches (890 mm) minimum and 37 inches (940 mm) maximum.

The ambulatory accessible compartment shall have a self-closing door, which shall not swing into the minimum required compartment area. Grab bars, complying with Sections 1127A.4.2, 1127A.4.3, 1127A.4.4 and 1127A.4.5, shall be installed on each compartment side wall. (See Figure 11A-9A (d).)

**1127A.2.2 Single-accommodation toilet facilities.** Single-accommodation toilet facilities shall comply with the following:

**Note:** See Figures 11A-9A and 11A-9B.

1. **Wheelchair clearance.** There shall be sufficient space in the toilet room for a wheelchair measuring 30 inches (762 mm) wide by 48 inches (1219 mm) long to enter the room and permit the door to close. There shall be in the room a clear turning space of at least 60 inches (1524 mm) in diameter or a T-shaped space complying with Section 1138A.1.3.

Required clear floor space, clearance at fixtures, and turning space shall be permitted to overlap.

2. **Encroachment of doors.** Doors shall not encroach into the turning space specified in Item 1 of this section by more than 12 inches (305 mm).

3. **Accessible water closet.** A water closet fixture located in a single-accommodation toilet facility shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from the side wall or partition.

Clearance around a water closet shall be 60 inches (1524 mm) minimum measured perpendicular from the side wall and 56 inches (1422 mm) minimum measured perpendicular from the rear wall. The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures, and the turning space. No other fixtures or

obstructions shall be located within the required water closet clearance.

A minimum 48 inches (1219 mm) deep and 60 inches (1524 mm) wide clear maneuvering space shall be provided in front of the water closet.

4. **Grab bars.** Grab bars shall be provided on the side wall closest to the water closet and on the rear wall. Grab bars shall comply with this section and Section 1127A.4.

The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extend 54 inches (1372 mm) minimum from the rear wall. The front end of the side grab bar shall be positioned 24 inches (610 mm) minimum in front of the water closet.

The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

**Exceptions:**

1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, when wall space does not permit a length of 36 inches (914 mm) minimum due to the location of a recessed fixture adjacent to the water closet.
2. When the enforcing agency requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.
5. **Accessible route.** All doors, fixtures and controls shall be on an accessible route. The minimum clear width of an accessible route shall be 36 inches (914 mm) except at doors (See Section 1126A). If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be as specified in Section 1138A.1.5.

**1127A.2.3 Water closets.** Water closets required to be accessible shall comply with the following:

**Note:** See Figure 11A-9B.

1. **Height.** The height of accessible water closets shall be a minimum of 17 inches (432 mm) to a maximum of 19 inches (483 mm) measured to the top of a maximum 2-inch-high (50.8 mm) toilet seat.
2. **Controls.** Flush controls shall be hand operated or automatic. Hand operated controls shall be operable with one hand and shall not require tight grasping, pinching or twisting. Controls for the flush valves shall be mounted on the open side of the water closet no more than 44 inches (1118 mm) above the floor. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

3. **Toilet seats.** Seats shall not be sprung to return to a lifted position.

**1127A.2.4 Accessible urinals.** When urinals are provided, at least one shall comply with the following:

1. **Height and wall projection.** Urinals shall be floor mounted (stall type) or wall hung. The rim of the wall hung urinals shall be 17 inches (432 mm) maximum above the finish floor. Urinals (floor mounted and wall hung) shall be 13½ inches (343 mm) deep minimum measured from the outer face of the rim to the back of the fixture.
2. **Flush controls.** Flush controls shall be hand operated or automatic. Hand operated controls shall be operable with one hand, shall not require tight grasping, pinching or twisting of the wrist and shall be mounted no more than 44 inches (1118 mm) above the floor. The force required to activate controls shall be no greater than 5 pounds (22.2 N). Electronic automatic flushing controls are preferable.
3. **Clear floor space.** A clear floor space 30 inches by 48 inches (762 mm by 1219 mm) shall be provided in front of the urinal to allow forward approach. The clear floor space shall comply with Section 1138A.1.4.

**1127A.3 Accessible lavatories.** When common use lavatories are provided for residents or guests, at least one, and not less than 1 percent of all lavatories, shall comply with the following:

1. **Location.** Lavatories shall be installed with the centerline of the fixture a minimum of 18 inches (457 mm) horizontally from an adjoining wall, partition or fixture. The top of the fixture rim shall be a maximum of 34 inches (864 mm) above the finished floor.
2. **Floor space.** A clear floor space at least 30 inches by 48 inches (762 mm by 1219 mm) shall be provided in front of accessible lavatories to allow forward approach. Such clear floor space shall adjoin or overlap an accessible route or another clear floor space.
3. **Knee and toe space.** A clear and obstructed knee and toe space, complying with Section 1138A.2, shall be provided underneath the lavatory. The knee and toe space shall be centered on the fixture. The clear floor space required by Item 2 shall not extend into the knee and toe space more than 19 inches (483 mm). (See Figure 11A-9D.)
4. **Finished floor.** The finished floor beneath the lavatory shall be extended to the wall.
5. **Plumbing protection.** Water supply and drain pipes accessible under lavatories shall be insulated or otherwise covered to protect against contact. There shall be no sharp or abrasive surfaces under lavatories.
6. **Lavatory faucet controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall



be no greater than 5 pounds (22.2N). Lever operated, push type and electronically controlled mechanisms are examples of acceptable designs. Hand operated metering faucets are allowed if the faucet remains open for at least 10 seconds.

#### **1127A.4 Grab bars, tub and shower seats, fasteners and mounting devices.**

**1127A.4.1 General.** Grab bars, tub and shower seats, fasteners and mounting devices required by this chapter shall comply with this section.

**1127A.4.2 Location.** Grab bars shall be installed in a horizontal position, 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface.

**Exception:** The height of the lower grab bar on the back wall of a bathtub shall comply with Section 1127A.5.2.

**1127A.4.3 Diameter or width.** The diameter or width of the gripping surfaces of a grab bar shall comply with the following:

**Note:** See Figure 11A-9C.

1. **Circular cross section.** Grab bars with circular cross section shall have an outside diameter of 1 $\frac{1}{4}$  inches (32 mm minimum and 2 inches (51 mm) maximum.
2. **Non-circular cross section.** Grab bars with non-circular cross section shall have a cross-section dimension of 2 inches (51 mm) maximum. The perimeter dimension of grab bars with non-circular cross section shall be 4 inches (102 mm) minimum and 4.8 inches (122 mm) maximum.
3. **Alternate configuration.** L-shaped or U-shaped grab bars shall be permitted.

**1127A.4.4 Structural strength.** The structural strength of grab bars, tub and shower seats, fasteners and mounting devices shall meet the following specifications:

1. Bending stress in a grab bar or seat induced by the maximum bending moment from the application of a 250-pound (1112 N) point load shall be less than the allowable stress for the material of the grab bar or seat.
2. Shear stress induced in a grab bar or seat by the application of a 250-pound (1112N) point load shall be less than the allowable shear stress for the material of the grab bar or seat, and if its mounting bracket or other support is considered to be fully restrained, then direct and torsional shear stresses shall not exceed the allowable shear stress.
3. Shear force induced in a fastener or mounting device from the application of a 250-pound (1112 N) point load shall be less than the allowable lateral load of either the fastener or mounting device or the supporting structure, whichever is the smaller allowable load.

4. Tensile force induced in a fastener by a direct tension force of a 250-pound (1112 N) point load, plus the maximum moment from the application of a 250-pound (1112 N) point load, shall be less than the allowable withdrawal load between the fastener and supporting structure.

5. Grab bars shall not rotate within their fittings.

**1127A.4.5 Surface.** A grab bar and any wall or other surface adjacent to it shall be free of any sharp or abrasive elements and shall have rounded edges.

**1127A.4.6 Spacing.** When grab bars are mounted adjacent to a wall, the space between the wall and the grab bars shall be 1 $\frac{1}{2}$  inches (38 mm). (See Figure 11A-9C). The space between the grab bar and projecting objects below and at the ends shall be 1 $\frac{1}{2}$  inches (38 mm) minimum. The space between the grab bar and projecting objects above shall be 12 inches (305 mm) minimum.

#### **Exceptions:**

1. The space between the grab bars and shower controls, shower fittings, and other grab bars above shall be permitted to be 1 $\frac{1}{2}$  inches (38 mm) minimum.
2. For L-shaped or U-shaped grab bars the space between the walls and the grab bar shall be 1 $\frac{1}{2}$  inches (38 mm) minimum for a distance of 6 inches (152 mm) on either side of the inside corner between two adjacent wall surfaces.

#### **1127A.5 Bathing facilities.**

**1127A.5.1 General.** When common use bathing facilities are provided for residents or guests, including showers, bathtubs or lockers, at least one of each type of fixture in each facility, and not less than 1 percent of all fixtures, shall comply with this section.

**1127A.5.2 Bathtubs.** Bathtubs required to be accessible shall comply with the following:

**1127A.5.2.1 Floor space.** Clearance in front of bathtubs shall extend the length of the bathtub and shall be 48 inches (1219 mm) wide minimum for forward approach and 30 inches (762 mm) wide minimum for parallel approach. A lavatory complying with Section 1127A.3 shall be permitted at the control end of the clearance. When a permanent seat is provided at the head end of the bathtub, the clearance shall extend 12 inches (305 mm) minimum beyond the wall at the head end of the bathtub. (See Figure 11A-9E.)

**1127A.5.2.2 Seat.** A removable in-tub seat or a permanent seat at the head end of the tub shall be provided. The structural strength of seats and their attachments shall comply with Section 1127A.4.4. Seats shall be mounted securely and shall not slip during use.

The top of bathtub seats shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. The depth of a removable in-tub seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum. Permanent seats at the head end of the bathtub shall be 15 inches (381 mm)

deep minimum and shall extend from the back wall to or beyond the outer edge of the bathtub. (See Figure 11A-9E).

**1127A.5.2.3 Grab bars.** Grab bars complying with Section 1127A.4 shall be provided in accordance with this section. (See Figure 11A-9F.) When separate grab bars are required on adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting the dimensional requirements of this section shall be permitted.

1. **Bathtubs with permanent seats.** Two horizontal grab bars shall be installed on the back wall. One shall be located 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, and the other shall be located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be 48 inches (1219 mm) long minimum, and shall be installed 15 inches (381 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub.

2. **Bathtubs with removable seats.** Two horizontal grab bars shall be installed on the back wall. One shall be located 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, and the other shall be located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be 24 inches (610 mm) long minimum and shall be installed 24 inches (610 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub. A grab bar 12 inches (305 mm) long minimum shall be installed on the head end wall at the front edge of the bathtub.

**1127A.5.2.4 Controls.** Faucets and controls (other than drain stoppers) shall be located on an end wall between the bathtub rim and grab bar, and between the open side of the bathtub and the centerline of the width of the bathtub. (See Figure 11A-9F.)

Controls shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

**1127A.5.2.5 Shower spray unit.** A shower spray unit with a hose at least 59 inches (1524 mm) long that can be used both as a fixed shower head and as a hand-held shower shall be provided.

The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height

shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of the grab bars.

**1127A.5.2.6 Bathtub enclosures.** When provided, enclosures for bathtubs shall not obstruct controls, faucets, shower and spray units, or obstruct transfer from wheelchairs onto bathtub seats or into bathtubs. Enclosures on bathtubs shall not have tracks installed on the rim of the open face of the bathtub.

**1127A.5.3 Shower compartments.** Shower compartments required to be accessible shall comply with this section. (See Figures 11A-9H, 11A-9I, 11A-9J and 11A-9K.)

#### **1127A.5.3.1 Size and clearance.**

1. **Standard roll-in shower compartments.** Standard roll-in shower compartments shall meet one of the following:

- 1.1 30 inches (762 mm) minimum in depth and 60 inches (1524 mm) minimum in width between wall surfaces measured at center points of opposing sides, with a full opening width on the long side.

A clear floor space 30 inches (914 mm) minimum by 60 inches (1524 mm) minimum shall be provided adjacent to the open face of the shower compartment.

- 1.2 42 inches (1067 mm) in width between wall surfaces, and 48 inches (1219 mm) minimum in depth with an entrance opening of 42 inches (1067 mm).

2. **Alternate roll-in shower compartments.** Alternate roll-in shower compartments shall be 36 inches (914 mm) minimum in depth and 60 inches (1524 mm) minimum in width between wall surfaces measured at center points of opposing sides. A 36-inch (914 mm) wide minimum entry shall be provided at one end of the long side of the compartment.

**1127A.5.3.2 Thresholds.** Thresholds in roll-in shower compartments shall be  $\frac{1}{2}$  inch (12.7 mm) maximum in height and shall be beveled with a slope no greater than one unit vertical in two units horizontal (50-percent slope). (See Figure 11A-1F.)

**Exception:** Changes in level not exceeding  $\frac{1}{4}$  inch (6.35 mm) shall be permitted to be vertical.

**1127A.5.3.3 Enclosures.** Enclosures, when provided for shower compartments, shall not obstruct controls, faucets, shower spray units, and transfer from wheelchairs onto shower seats.

**1127A.5.3.4 Floor.** Shower compartment floor surfaces shall be stable, firm and slip resistant. The maximum slope of the floor shall be  $\frac{1}{4}$  inch (6.35 mm) per foot (2.083 percent slope) in any direction. When drains are provided, grate openings shall be  $\frac{1}{4}$  inch (6.35 mm) maximum and located flush with the floor surface.

**1127A.5.3.5 Controls.** Controls, faucets and shower spray units in shower compartments shall be operable with one hand, and shall not require tight grasping,

pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum. All controls and faucets shall be of a single-lever design.

**1127A.5.3.5.1 Standard roll-in shower compartments.** In standard roll-in shower compartments, operable parts of controls and faucets shall be installed on the back wall of the compartment adjacent to the seat wall, 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall.

Operable parts of controls and faucets shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor, with their centerline at 39 inches (991 mm) minimum and 41 inches (1041 mm) maximum above the shower floor.

Operable parts of the shower spray unit, including the handle, shall be installed on the back wall adjacent to the seat wall, 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall.

Operable parts of the shower spray unit, including the handle, shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor (measured to the top of the mounting bracket).

**1127A.5.3.5.2 Alternate roll-in shower compartments.** In alternate roll-in shower compartments, operable parts of controls and faucets shall be installed on the side wall of the compartment adjacent to the seat wall, 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall.

Operable parts of controls and faucets shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor, with their centerline at 39 inches (991 mm) minimum and 41 inches (1041 mm) maximum above the shower floor.

Operable parts of the shower spray unit, including the handle, shall be installed on the following locations:

1. On the side wall of the compartment adjacent to the seat wall, 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the seat wall; or
2. On the back wall opposite the seat, 15 inches (381 mm) maximum, left or right, of the centerline of the seat.

Operable parts of the shower spray unit, including the handle, shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor.

**1127A.5.3.6 Hand-held shower sprayer unit.** A flexible hand-held shower spray unit with a hose at least 59 inches (1524 mm) long that can be used both as a fixed

shower head and as a hand-held shower shall be provided.

The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars.

**1127A.5.3.6.1 Sprayer unit alternative.** When accessible shower facilities are provided in areas subject to excessive vandalism, in lieu of providing the fixed flexible hose, two wall-mounted shower heads shall be installed. Each shower head shall be installed so that it can be operated independently of the other and shall have swivel angle adjustments, both vertically and horizontally. One shower head shall be located at a height of 48 inches (1219 mm) maximum above the floor.

**1127A.5.3.7 Shower compartment seats.** A seat in a standard roll-in shower compartment shall be a folding type, installed on the side wall adjacent to the controls. The seat shall extend from the back wall to a point within 3 inches (76 mm) of the compartment entry. A seat in an alternate roll-in type shower compartment shall be a folding type, installed on the front wall opposite the back wall, and shall extend from the adjacent side wall to a point within 3 inches (76 mm) of the compartment entry.

Shower compartment seats shall comply with Section 1127A.4.4 and shall be located within 27 inches (686 mm) of the shower controls. The top of the seat shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. When folded, the seat shall not extend more than 6 inches (152 mm) from the mounting wall.

**1127A.5.3.7.1 Rectangular seats.** The rear edge of a rectangular seat shall be 2½ inches (64 mm) maximum from the seat wall. The front edge of a rectangular seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The side edge of the seat shall be 1½ inches (38 mm) maximum from the adjacent wall.

**1127A.5.3.7.2 L-shaped seats.** The rear edge of an L-shaped seat shall be 2½ inches (64 mm) maximum from the seat wall. The front edge of an L-shaped seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The rear edge of the "L" portion of the seat shall be 1½ inches (38 mm) maximum from the wall. The front edge shall be 14 inches (356 mm) minimum and 15 inches (381 mm) maximum from the wall. The end of the "L" shall be 22 inches (559 mm) minimum and 23 inches (584 mm) maximum from the main seat wall.

**1127A.5.3.8 Grab bars.** Accessible shower compartments shall be provided with grab bars, installed in accordance with Section 1127A.5.3.8.1 or Section 1127A.5.3.8.2. Grab bars shall also comply with Section 1127A.4.

When multiple grab bars are used, required horizontal grab bars shall be installed at the same height above the finish floor. When separate grab bars are required on adjacent walls at a common mounting height, L-shaped or U-shaped grab bars meeting the dimensional requirements of Section 1127A.5.3.8.1 or Section 1127A.5.3.8.2 shall be permitted. (See Figure 11A-9H or Figure 11A-9I.)

**1127A.5.3.8.1 Standard roll-in shower compartments.** Grab bars shall be installed on the back wall and on the side wall opposite the seat. Grab bars above the seat are not permitted. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

**1127A.5.3.8.2 Alternate roll-in shower compartments.** Grab bars shall be installed on the back wall and the side wall farthest from the compartment entry. Grab bars above the seat are not permitted. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

**1127A.5.3.9 Soap dish.** When a soap dish is provided, it shall be located on the control wall at a maximum height of 40 inches (1016 mm) above the shower floor, and within the reach limits from the seat.

**1127A.5.3.10 Open showers.** When no separate shower compartments are provided, the shower for persons with disabilities shall be located in a corner with L-shaped grab bars extending along two adjacent walls with a folding seat adjacent to the shower controls. (See Figure 11A-9J.)

**1127A.5.3.11. Multiple showers.** When two or more accessible showers are provided within the same functional area, there shall be at least one shower constructed opposite hand from the other or others (i.e., one left-hand control versus right-hand controls).

#### **1127A.6 Lockers.**

**1127A.6.1 General.** Where lockers are provided for residents or guests, at least one locker and not less than 1 percent of all lockers shall be accessible to persons with disabilities. An accessible route not less than 36 inches (914 mm) in clear width shall be provided to these lockers. See Section 1138A for required clear space, allowable reach ranges and requirements for control and operating mechanisms.

#### **1127A.7 Signs.**

**1127A.7.1 General.** All accessible toilet and bathing facilities shall be identified by the "International Symbol of Accessibility." Signs need not be provided for facilities within a dwelling unit or guestroom.

**1127A.7.2 Identification symbols.** Doorways leading to sanitary facilities (toilet or bathing rooms) shall be identified by a geometric symbol in compliance with this section. Geometric symbols shall be centered horizontally on the door at a height of 58 inches (1473 mm) minimum and 60 inches (1524 mm) maximum above the finish floor measured to the center of the symbol. When a door is pro-

vided, the symbol shall be mounted within 1 inch (25 mm) of the vertical centerline of the door. Directional signs indicating the location of the nearest accessible toilet or bathing rooms shall be provided. Such directional signs shall comply with Section 1143.5 and shall include the International Symbol of Accessibility.

Edges of accessibility signage shall be rounded, chamfered or eased. Corners shall have a minimum radius of  $\frac{1}{8}$  inch (3.2 mm). See Section 1143A for additional signage requirements applicable to sanitary facilities.

**1127A.7.2.1 Men's sanitary facilities.** Men's sanitary facilities shall be identified by an equilateral triangle,  $\frac{1}{4}$  inch (6.4 mm) thick with edges 12 inches (305 mm) long and a vertex pointing upward. The triangle symbol shall contrast with the door, either light on a dark background or dark on a light background.

**1127A.7.2.2 Women's sanitary facilities.** Women's sanitary facilities shall be identified by a circle,  $\frac{1}{4}$  inch (6.4 mm) thick and 12 inches (305 mm) in diameter. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background.

**1127A.7.2.3 Unisex sanitary facilities.** Unisex sanitary facilities shall be identified by a circle,  $\frac{1}{4}$  inch (6.4 mm) thick and 12 inches (305 mm) in diameter with a  $\frac{1}{4}$  inch (6.4 mm) thick triangle superimposed on the circle and within the 12-inch (305 mm) diameter. The triangle symbol shall contrast with the circle symbol, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background.

#### **1127A.8 Toilet room fixtures and accessories.**

**1127A.8.1 Towel, sanitary napkins, waste receptacles.** Where towel, sanitary napkins, waste receptacles and other similar dispensing and disposal fixtures are provided, at least one of each type shall be located with all operable parts, including coin slots, within 40 inches (1016 mm) from the finished floor. Controls and operating mechanisms shall comply with Section 1138A.4.

**1127A.8.2 Toilet tissue dispensers.** Toilet tissue dispensers shall be located on the wall or partition closest to the water closet, 7 inches (180 mm) minimum and 9 inches (230 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be below the grab bar, 19 inches (483 mm) minimum above the finish floor. The outlet of the dispenser shall not be located behind grab bars. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow. (See Figure 11A-9B.)

**1127A.8.3 Mirrors.** Where mirrors are provided, at least one shall be accessible. Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1016 mm) maximum above the finish floor. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (889 mm) maximum above the finish floor.

**1127A.9 Space allowances and reach ranges in common use areas.**

Space allowances and reach ranges in common use areas shall comply with Section 1138A.

**1127A.10 Common accessible laundry rooms.**

**1127A.10.1 General.** Where common use laundry rooms are provided, at least one of each type of appliance provided in each laundry area shall be accessible, shall be on an accessible route and shall comply with this section. Such appliances include clothes washing machines, dryers, soap dispensers and any related features such as wash sinks, tables and storage areas.

Where laundry rooms are provided on floors of an elevator building, each laundry room shall be accessible. Where there is one laundry room on a ground floor in each building, each laundry room shall be accessible. Where there is a laundry room on the ground floor of a building and another located in the basement, it is acceptable to have only the ground floor laundry room accessible.

**1127A.10.2 Clear floor space.** There shall be a minimum clear space 30 inches perpendicular by 48 inches parallel (762 mm by 1219 mm) in front of clothes washers and dryers required to be accessible. There shall be a minimum clear space 30 inches by 48 inches (762 mm by 1219 mm) provided for at least one of each type of fixture or appliance provided in the laundry room (e.g., soap dispensers, wash sinks, tables, storage areas).

**1127A.10.3 Controls and operating mechanisms.** Clothes washers and dryers including stacked clothes washers and dryers required to be accessible shall have controls and operating mechanisms (including doors, coin slots, lint screens, detergent and bleach compartments) within the reach range of a seated user. Controls and operating mechanisms shall be located no higher than 48 inches (1219 mm), and no lower than 15 inches (381 mm), above the finished floor measured to the center of the grip. If the reach is over an obstruction (for example, washer or dryer), operating mechanisms shall be located within the reach ranges specified in Section 1138A.3. Controls and operating mechanisms that do not satisfy these specifications are acceptable, provided that comparable mechanisms, controls or outlets that perform the same functions are provided within the same area and are accessible.

Controls and operating mechanisms shall be operable with one hand and not require tight grasping, pinching or twisting of the wrist. The force required to activate controls and operating mechanisms shall be no greater than 5 pounds (22.2N).

**1127A.10.4 Washing machines and clothes dryers.** Washing machines and clothes dryers in accessible common use laundry rooms shall be front loading.

The bottom of the opening to the laundry compartment shall be located 15 inches (381 mm) minimum and 36 inches (914 mm) maximum above the finish floor.

**1127A.11 Storage.**

**1127A.11.1 General.** If fixed storage facilities such as cabinets, shelves, closets or drawers are provided where access is required by Sections 1.8.2.1.2 and 1102A, at least one of each type of facility provided shall comply with this section. Additional storage may be provided outside of the reach ranges specified in Section 1138A.3.

**1127A.11.2 Clear floor space.** A clear floor space at least 30 inches by 48 inches (762 mm by 1219 mm) complying with Section 1138A.1.4 that allows either a forward or parallel approach by a person using a wheelchair shall be provided at accessible storage facilities.

**1127A.11.3 Height.** Accessible storage spaces and clothes rods shall be within at least one of the reach ranges specified in Section 1138A.3. (See Figure 11A-1J and Figure 11A-1L.)

**1127A.11.4 Hardware.** Hardware for accessible storage facilities shall comply with Section 1138A.4. Touch latches and U-shaped pulls are acceptable.

**1127A.12 Fixed or built-in seating, tables and counters.**

**1127A.12.1 Minimum seating.** Where fixed or built-in seating, tables or counters are provided for residents or guests, 5 percent, but not less than one, shall be accessible as provided in this section.

**1127A.12.2 Clear floor space.** When seating spaces for persons in wheelchairs are provided at fixed tables or counters, clear floor space complying with Section 1138A.1.4 positioned for a forward approach shall be provided. Such clear floor space shall not overlap the required knee and toe space by more than 19 inches (483 mm). (See Figure 11A-1K.)

**1127A.12.3 Knee and toe space.** When seating for persons in wheelchairs is provided at fixed tables or counters, knee and toe space complying with Section 1138A.2 shall be provided. (See Figure 11A-1K.)

**1127A.12.4 Height of work surfaces.** The tops of tables and counters shall be 28 inches to 34 inches (711 mm to 864 mm) from the finish floor.

**Exception:** When food or drink is served for consumption at a counter exceeding 34 inches (864 mm) in height, only a portion of the main counter, 60 inches (1524 mm) minimum in length, shall be provided in compliance with this section.

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### **SECTION 1128A COVERED DWELLING UNITS**

**1128A.1 General.** Covered multifamily dwelling units shall be adaptable and accessible into and throughout the dwelling unit as provided in this division.

**Note:** See Sections 1101A “Application” and 1102A “Building Accessibility” for dwelling units required to comply with this division.

### **SECTION 1129A Reserved**

### **SECTION 1130A ACCESSIBLE ROUTE WITHIN COVERED MULTIFAMILY DWELLING UNITS**

**1130A.1 General.** An accessible route shall be provided through all rooms and spaces of the dwelling unit. The accessible route shall pass through the primary entry door, and shall connect with all additional exterior doors, required clear floor spaces at kitchen appliances and bathroom fixtures. For the purpose of this section, “accessible routes” may include hallways, corridors and ramps.

**Exception:** An accessible route is not required from the interior of the unit into a basement or garage, except as provided in Section 1105A.1.

**1130A.2 Width.** The accessible route into and throughout covered multifamily dwelling units shall be at least 36 inches (914 mm) wide.

### **SECTION 1131A CHANGES IN LEVEL ON ACCESSIBLE ROUTES**

**1131A.1 Changes in level not exceeding  $\frac{1}{2}$  inch.** Abrupt changes in level along any accessible route shall not exceed  $\frac{1}{2}$  inch (12.7 mm). When changes in level do occur, they shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level not exceeding  $\frac{1}{4}$  inch (6.35 mm) may be vertical.

**1131A.2 Changes greater than  $\frac{1}{2}$  inch.** Changes in level greater than  $\frac{1}{2}$  inch (12.7 mm) shall be made by means of a ramp, elevator or platform (wheelchair) lift. See Section 1122A for ramps and Section 1124A.11 for platform (wheelchair) lifts.

### **SECTION 1132A DOORS**

**1132A.1 Primary entry doors and required exit doors.** The width and height of primary entry doors and all required exit doors shall comply with Section 1126A.1. The requirements of Sections 1126A.3 shall apply to maneuvering clearances at the side of the door exposed to common or public use spaces (e.g., entry or exit doors which open from the covered multifamily dwelling unit into a corridor, hallway or lobby, or directly to the outside).

**1132A.2 Interior doors and secondary exterior doors.** Except as allowed by Section 1109A.2, interior doors intended for user passage and secondary exterior doors shall comply with this section. The provisions of this section shall apply to the dwelling unit side of doors leading from the interior of the dwelling unit to an unfinished basement or an attached garage.

**1132A.3 Width and height of interior doors and secondary exterior doors.** Doors shall comply with the following:

1. Doors shall not be less than 6 feet 8 inches (2032 mm) in height.
2. Swinging doors shall provide a net clear opening width of not less than 32 inches (813 mm), measured with the door or doors positioned at an angle of 90 degrees from the closed position. A 34-inch (864 mm) door is acceptable.
3. Swinging doors shall be capable of opening at least 90 degrees.
4. A nominal 32-inch (813 mm) clear opening provided by a standard 6-foot wide (1829 mm) sliding patio door assembly is acceptable.
5. A pair of doors, manual or automatic, must have at least one leaf which provides a clear width of not less than 32 inches (813 mm), measured with the door positioned at an angle of 90 degrees from its closed position.
6. The width of any component in the means of egress system shall not be less than the minimum width required by Section 1005.

**1132A.4 Level floor or landing.** See also Chapter 10. The floor or landing on each side of a door shall be level. Primary entry doors, required exit doors or secondary exterior doors with changes in height between the interior surface or floor level and the exterior surface or floor level shall comply with the following:

1. Exterior landings of impervious construction (e.g., concrete, brick, flagstone) serving primary entry doors and required exit doors are limited to not more than  $\frac{1}{2}$  inch (12.7 mm) of change in height between floor surfaces. Changes in level shall comply with Section 1131A.

2. Exterior landings of pervious construction (e.g., wood decking with spaces) shall be the same level as the interior landing, except that secondary exterior doors may have no more than  $\frac{1}{2}$  inch (12.7 mm) of change in height between floor surfaces. Changes in level shall comply with Section 1131A.
3. Secondary exterior doors onto decks, patios or balcony surfaces constructed of impervious materials (e.g., concrete, brick, flagstone) may have a maximum change in height from the interior landing of 4 inches (101.6 mm). Changes in height greater than  $\frac{1}{2}$  inch (12.7 mm) shall be accomplished by means of a ramp complying with Section 1114A or by means of a platform constructed to the level of the floor as illustrated in Figure 11A-8J.
4. Secondary exterior doors onto decks, patios or balcony surfaces constructed of impervious materials (e.g., concrete, brick, flagstone) may have a maximum change in height from the interior landing of 1 inch (25.4 mm), provided a ramp with a maximum slope of 1:8 is permanently installed. (See Figure 11A-8K.)
5. In buildings containing covered multifamily dwelling units, the floor or landing immediately outside the entry may be sloped up to  $\frac{1}{4}$  inch (6.35 mm) per foot (12 inches) (305 mm), in a direction away from the primary entrance of the dwelling unit for drainage.

**1132A.4.1 Thresholds.** Thresholds at the primary entry and required exit doors shall be no higher than  $\frac{1}{2}$  inch (12.7 mm). Thresholds at secondary exterior doors, including sliding door tracks, shall be no higher than  $\frac{3}{4}$  inch (19.05 mm). Changes in height at interior door thresholds (e.g., floor material changes at door thresholds) shall not exceed  $\frac{1}{2}$  inch (12.7 mm). Thresholds shall comply with the following:

1. Thresholds with a change in height of not more than  $\frac{1}{4}$  inch (6.35 mm) may be vertical.
2. Thresholds with a change in height between  $\frac{1}{4}$  inch (6.35 mm) and  $\frac{3}{4}$  inch (19.05 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope).

#### **1132A.5 Maneuvering clearances at doors.**

**1132A.5.1 General.** Maneuvering clearances at interior doors shall provide a minimum length on both sides of the door of at least 42 inches (1067 mm) measured at a right angle to the plane of the door in its closed position.

##### **Exceptions:**

1. A 39-inch (991 mm) length is acceptable when a minimum clear opening width of 34 inches (864 mm) is provided.
2. The floor or landing on the dwelling unit side of the primary entry door and any required exit door shall have a minimum length of not less than 44 inches (1118 mm). Section 1126A.3 shall apply to maneuvering clearances at the side of

the door exposed to common or public use spaces.

**1132A.5.2 Strike edge maneuvering space at doors.** The width of the level area on the side to which the door swings shall extend 18 inches (457 mm) past the strike edge for all doors. The width of the level area at the exterior side of the primary entry door and any required exit doors shall comply with Section 1126A.

##### **Notes:**

1. See Section 1134A for bathrooms that are required to be accessible.
2. Twenty-four inches (610 mm) is preferred for strike edge clearance.

**1132A.6 Closer-effort to operate doors.** Maximum effort to operate doors shall not exceed  $8\frac{1}{2}$  pounds (38 N) for exterior doors and 5 pounds (22 N) for interior doors, such pull or push effort being applied at right angles to hinged doors and at the center plane of sliding or folding doors. Compensating devices or automatic door operators may be utilized to meet these standards. When fire doors are required, the maximum effort to operate the door may be increased to the minimum allowable by the appropriate enforcement agency, not to exceed 15 pounds (66.7 N).

**1132A.7 Type of lock or latch.** The type of latch and lock required for all doors shall be in accordance with Section 1132A.8 and Chapter 10, Section 1008.

**1132A.8 Hand-activated door hardware.** Hand-activated door latching, locking and opening hardware shall be centered between 30 inches (762 mm) and 44 inches (1118 mm) above the floor. Latching and locking doors that are hand-activated and on an accessible route shall be operable with a single effort by lever-type hardware, panic bars, push-pull activating bars or other hardware designed to provide passage without requiring the ability to grasp the opening hardware. Locked exit doors shall operate consistent with Section 1132A.6, in the direction of egress.

**1132A.8.1 Lever-type hardware.** The lever or lever of actuated latches or locks shall be curved with a return to within  $\frac{1}{2}$  inch (12.7 mm) of the door to prevent catching on the clothing of persons during egress in Group R and U occupancies with an occupant load greater than 10.

**1132A.9 Smooth surface.** The bottom 10 inches (254 mm) of all doors shall have a smooth, uninterrupted surface to allow the door to be opened by a wheelchair footrest without creating a trap or hazardous condition. Where narrow frame doors are used, a 10-inch-high (254 mm) smooth panel shall be installed on the push side of the door which will allow the door to be opened by a wheelchair footrest without creating a trap or hazardous condition.

**Exception:** Automatic and sliding doors.

**1132A.10 Door signal devices.** Every primary entrance to a covered multifamily dwelling unit shall be provided with a door buzzer, bell, chime or equivalent. The activating mechanism shall be mounted a maximum of 48 inches (1219 mm) above the floor and connected to permanent wiring.

## SECTION 1133A KITCHENS

**1133A.1 General.** Kitchens shall be on an accessible route and shall comply with this section.

**1133A.2 Clear floor space.** Clear floor space at kitchens shall comply with the following:

1. A clear floor space at least 30 inches (762 mm) by 48 inches (1219 mm) that allows a parallel approach by a person in a wheelchair shall be provided at the range or cooktop.
2. A clear floor space at least 30 inches (762 mm) by 48 inches (1219 mm) that allows either a parallel or forward approach shall be provided at the kitchen sink and all other fixtures or appliances including the oven, dishwasher, refrigerator/freezer and trash compactor.
3. The centerline of the 30-inch (762 mm) by 48-inch (1219 mm) clear floor space provided for parallel or forward approach shall be aligned with the centerline of the appliance or fixture. (See Figure 11A-10A.)

**1133A.2.1 Clear width.** Kitchens shall have a minimum clear width measured between any cabinet, countertop or the face of any appliance (excluding handles and controls) that projects into the kitchen and the opposing cabinet, countertop, appliance or wall as follows:

1. U-shaped kitchens, designed with parallel approach at a range or cooktop located at the base of the U, shall have a minimum clear width of at least 60 inches (1524 mm). (See Figure 11A-10A.)
2. U-shaped kitchens, designed with a cooktop or sink located at the base of the U, which provides a knee and toe space in accordance with Section 1133A.7 to allow for a forward approach, shall have a clear width of at least 48 inches (1219 mm). (See Figure 11A-10A.)
3. All other kitchen designs shall provide a minimum clear width of at least 48 inches (1219 mm). (See Figure 11A-10A.)

**1133A.3 Removable base cabinets.** Base cabinets directly under the kitchen sink counter area, including toeboard and shelving, shall be removable without the use of specialized tools or specialized knowledge in order to provide knee and toe space for a wheelchair. The finish floor beneath the kitchen sink counter area shall be extended to the wall.

**1133A.4 Countertops.** Kitchen countertops shall comply with this section and shall be provided with the following (see Section 1133A.4.1 for repositionable countertop requirements):

1. A minimum linear length of 30 inches (762 mm) of countertop shall be provided for the kitchen sink installation.
2. A minimum linear length of 30 inches (762 mm) of countertop shall be provided for a work surface.
3. The sink and work surface may be a single integral unit a minimum of 60 inches (1524 mm) in length, or be separate components.

**Exception:** Two 15-inch (381 mm) minimum width breadboards may be provided in lieu of the required 30 inches (762 mm) of countertop work surface.

**1133A.4.1 Repositionable countertops.** Repositionable countertops shall be provided in a minimum of 5 percent of the covered multifamily dwelling units. Repositionable countertops shall comply with the following:

1. The kitchen sink and work surface space required by Section 1133A.4 shall be designed to enable repositioning to a minimum height of 28 inches (711 mm).
2. Base cabinets directly under the kitchen sink counter area and work surface shall be removable as required in Section 1133A.3.
3. The sides of adjacent cabinets and the back wall, which may become exposed to moisture or food handling when a countertop is lowered, shall be constructed of durable, nonabsorbent materials appropriate for such uses.
4. Finished flooring shall be extended to the wall beneath the sink and work surface.

### Exceptions:

1. Stone, cultured stone and tiled countertops may be used without meeting the repositioning requirements.
2. Two 15-inch (381 mm) minimum width breadboards may be provided in lieu of the required 30 inches (762 mm) of countertop work surface.

**1133A.5 Lower shelving.** Lower shelving and/or drawer space shall be provided in the kitchen at a height of no more than 48 inches (1219 mm) above the floor.

**1133A.6 Kitchen sink faucet controls.** Faucet controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls shall be no greater than 5 pounds (22.2N). Lever-operated, push-type and electronically controlled mechanisms are examples of acceptable designs. Self-closing valves are allowed if the faucet remains open for at least 10 seconds.

**1133A.7 Knee and toe space.** Knee and toe space, when required by Section 1133A, shall comply with the following:

1. The knee and toe space shall be clear and unobstructed, or removable base cabinets in compliance with Section 1133A.3 shall be provided.
2. The knee and toe space shall be 30 inches (762 mm) wide minimum, centered on the sink, countertop or appliance.
3. The knee space shall be at least 27 inches (686 mm) above the finish floor.
4. The knee space shall be 11 inches (279 mm) deep minimum at 9 inches (229 mm) above the finish floor, and 8 inches (203 mm) deep minimum at 27 inches (686 mm) above the finish floor, measured from the front edge.



5. The toe space shall be at least 9 inches (229 mm) above the finish floor.

6. A clear floor space shall not extend into the knee and toe space more than 19 inches (483 mm).

**1133A.7.1 Plumbing protection.** Water supply and drain pipes under kitchen sinks shall be insulated or otherwise covered. There shall be no sharp or abrasive surfaces under kitchen sinks.

## SECTION 1134A BATHING AND TOILET FACILITIES

**1134A.1 General.** All bathrooms, bathing and toilet facilities within covered multifamily dwelling units shall comply with this section.

**1134A.2 Number of complying bathrooms.** Bathrooms shall be designed to comply with one of the following options:

**Option 1.** All bathrooms within the dwelling unit shall be designed to comply with the following:

1. Toilet, bathing and shower facilities shall comply with Section 1134A.4.
2. Bathtubs shall comply with Section 1134A.5.
3. Showers shall comply with Section 1134A.6.
4. Water closets shall comply with Section 1134A.7.
5. Lavatories, vanities, mirrors and towel fixtures shall comply with Section 1134A.8.
6. Bathrooms shall be provided with an accessible route into and through the bathroom.
7. If a door is provided, it shall comply with the requirements of Section 1132A.5.
8. A minimum 18-inch (457 mm) clear maneuvering space shall be provided on the swing side of the door at the strike edge of the door.
9. Switches, outlets and controls shall comply with Section 1142A.
10. Reinforced walls to allow for the future installation of grab bars around the toilet, tub and shower shall comply with Sections 1134A.5 for bathtubs, 1134A.6 for showers and 1134A.7 for water closets. Grab bars shall comply with Sections 1127A.4- and 1127A.2.2, Item 4.

**Option 2.** Only one bathroom within the dwelling unit shall be designed to comply with the following:

1. Toilet, bathing and shower facilities shall comply with Section 1134A.4.
2. Bathtubs shall comply with Section 1134A.5.
3. Showers shall comply with Section 1134A.6.
4. Water closets shall comply with Section 1134A.7.
5. Lavatories, vanities, mirrors and towel fixtures shall comply with Section 1134A.8.
6. Where both a tub and shower are provided in the bathroom, at least one shall be made accessible. Additional requirements apply to dwelling units

containing two or more bathrooms when a bathtub is provided as the accessible bathing fixture.

Where two or more bathrooms are provided within the same dwelling unit and a bathtub is installed to comply with Option 2, Item 6 in one bathroom and a shower stall is provided in a subsequent bathroom, both the bathtub selected to comply with Option 2, Item 6 and at least one shower stall within the dwelling unit shall meet all the applicable accessibility requirements provided in Section 1134A. (See Section 1134A.5 for bathtubs, or Section 1134A.6 for showers.)

7. When two or more lavatories are provided, at least one shall be made accessible and comply with Section 1134A.8.
8. Bathrooms shall be provided with an accessible route into and through the bathroom.
9. If a door is provided, it shall comply with the requirements of Section 1132A.5.
10. A minimum 18-inch (457 mm) clear maneuvering space shall be provided on the swing side of the door at the strike edge of the door.
11. Switches, outlets and controls shall comply with Section 1142A.
12. Reinforced walls to allow for the future installation of grab bars around the toilet, tub and shower shall comply with Sections 1134A.5 for bathtubs, 1134A.6 for showers and 1134A.7 for water closets. Grab bars shall comply with Sections 1127A.4 and 1127A.2.2, Item 4.

When Option 2 is used, all additional bathrooms must comply with Items 8 through 12 above.

**1134A.3 Powder rooms.** All powder rooms shall be designed to comply with Section 1134A.2, Option 2, Items 8 through 12. When the powder room is the only toilet facility located on an accessible level, it shall comply with the Option 2 items listed above, plus all additional requirements located in Sections 1134A.4, 1134A.7 and 1134A.8.

**1134A.4 Sufficient maneuvering space.** Bathing and toilet facilities required to be adaptable shall provide sufficient maneuvering space for a person using a wheelchair or other mobility aid to enter and close the door, use the fixtures, reopen the door and exit.

Where the door swings into the bathroom or powder room, there shall be a clear maneuvering space outside the swing of the door of at least 30 inches by 48 inches (762 mm by 1219 mm) within the room. The clear maneuvering space shall allow the user to position a wheelchair or other mobility aid clear of the path of the door as it is closed and to permit use of fixtures.

Doors may swing into the required clear space at any fixture when a clear maneuvering space is provided outside the swing arc of the door so it can be closed.

Maneuvering spaces may include any knee space or toe space available below bathroom fixtures.

**1134A.5 Bathtubs.** Bathtubs required to be accessible shall comply with this section.

1. **Floor space.** There shall be a minimum clear floor space 48 inches parallel by 30 inches perpendicular (1219 mm by 762 mm) to the side of a bathtub or bathtub-shower combination (measured from the foot or drain end of the bathtub) to provide for the maneuvering of a wheelchair and transfer to and from the bathing facilities. The area under a lavatory may be included in the clear floor space provided the knee and toe space comply with Section 1134A.8. Cabinets under lavatories and toilets shall not encroach into the clear floor space.
2. **Reinforced walls for grab bars.** A bathtub installed without surrounding walls shall provide reinforced areas for the installation of floor-mounted grab bars.

Where a bathtub is installed with surrounding walls, grab bar reinforcement shall be located on each end of the bathtub, 32 inches to 38 inches (813 mm to 965 mm) above the floor, extending a minimum of 24 inches (610 mm) from the front edge of the bathtub toward the back wall of the bathtub. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height. (See Figure 11A-9G).

Grab bar reinforcement shall be installed on the back wall of the bathtub a maximum of 6 inches (152.4 mm) above the bathtub rim extending upward to at least 38 inches (965 mm) above the floor. Grab bar backing shall be installed horizontally to permit the installation of a 48-inch (1219 mm) grab bar with each end a maximum of 6 inches (152.4 mm) from the end walls of the bathtub. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height.

3. **Bathtub controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls shall be no greater than 5 pound-force (22.2 N). Lever operated, push type and electronically controlled mechanisms are examples of acceptable designs.

4. **Shower unit.** A shower spray unit is not required in bathtubs.
5. **Bathtub enclosures.** Doors and panels of bathtub enclosures shall be substantially constructed from approved, shatter-resistant materials. Hinged doors shall open outward. Glazing used in doors and panels of bathtub enclosures shall be fully tempered, laminated safety glass or approved plastic. When glass is used, it shall have minimum thickness of not less than 1/8 inch (3.17 mm) when fully tempered, or 1/4 inch (6.35 mm) when laminated, and shall pass the test requirements of this part, Chapter 24, Glass and Glazing. Plastics used in doors and panels of bathtub enclosures shall be of a shatter-resistant type.

**1134A.6 Showers.** Showers required to be accessible shall comply with this section.

1. **Size.** When one or more shower stalls are provided within the same dwelling units, at least one shower stall comply with one of the following requirements.

- 1.1. The shower stall shall measure at least 42 inches wide by 48 inches deep (1067 mm by 1219 mm) with an entrance opening of at least 36 inches (914 mm); or

- 1.2. The shower stall shall measure at least 30 inches deep by 60 inches wide (762 mm by 1524 mm) with an entrance opening of at least 60 inches (1524 mm). A water closet may project a maximum of 12 inches (305 mm) into the opening, provided that a minimum of 36 inches (914 mm) clear space is maintained between the water closet and the shower wall as illustrated in Figure 11A-9L or;

- 1.3. Other shower stall configurations shall measure at least 36 inches deep by 60 inches wide (914 mm by 1524 mm) with an entrance opening of at least 36 inches (914 mm) when a wall is installed on the opening side.

2. **Slope.** The maximum slope of the shower floor shall be 1/2 inch (12.7 mm) per foot in any direction and shall slope to a drain. The floor surfaces shall be of Carborundum or grit-faced tile or of material providing equivalent slip resistance.

3. **Floor space.** A clear maneuvering space at least 30 inches in width by 48 inches in length (762 mm by 1219 mm) shall be located outside the shower, flush and parallel to the control wall.

4. **Reinforced walls for grab bars.** Grab bar reinforcement shall be installed continuous in the walls of showers 32 inches to 38 inches (813 mm to 965 mm) above the floor. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height.

Glass-walled shower stalls shall provide reinforcement for installation of floor-mounted or ceiling-mounted grab bars.

5. **Thresholds.** When a threshold is used, it shall be a maximum of 2 inches (50.8 mm) in height and have a beveled or sloped angle not exceeding 1 unit vertical in 2 units horizontal (26.6 degrees from the horizontal). Thresholds 1/2 inch (12.7 mm) or less in height may have a beveled or sloped angle not exceeding 1 unit vertical in 1 unit horizontal (45 degrees from the horizontal).

6. **Shower controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 pounds (22.2N). Lever operated, push-type and electronically controlled mechanisms are examples of acceptable designs.

7. **Shower enclosures.** Doors and panels of shower enclosures shall be substantially constructed from approved, shatter-resistant materials. Hinged shower doors shall open outward. Glazing used in doors and panels of shower enclosures shall be fully tempered, laminated safety glass or approved plastic. When glass is used, it shall have minimum thickness of not less than  $\frac{1}{8}$  inch (3.17 mm) when fully tempered, or  $\frac{1}{4}$  inch (6.35 mm) when laminated, and shall pass the test requirements of this part, Chapter 24, Glass and Glazing. Plastics used in doors and panels of shower enclosures shall be of a shatter-resistant type.

**1134A.7 Water closets.** Water closets in bathrooms or powder rooms required to be accessible shall comply with this section.

1. **Floor space and location.** The minimum floor space provided at a water closet shall be 48 inches (1219 mm) in clear width. The clear floor space shall extend past the front edge of the water closet at least 36 inches (914 mm). See Figure 11A-9M.

**Exception:** The 48-inch (1219 mm) minimum clear width may be reduced to 36 inches (914 mm) for lavatories, cabinets, wing walls or privacy walls located immediately adjacent to a water closet which extend no more than 24 inches (610 mm) in depth.

Water closets shall be located within bathrooms in a manner that permits a grab bar to be installed on one side of the fixture. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from a grab bar wall or partition. In locations where water closets are adjacent to non-grab bar walls, vanities, lavatories or bathtubs, the centerline of the fixture shall be a minimum of 18 inches (457 mm) from the obstacle.

2. **Reinforced walls for grab bars.** Where the water closet is not placed adjacent to a side wall capable of accommodating a grab bar, the bathroom shall have provisions for installation of floor-mounted, foldaway or similar alternative grab bars.

Where the water closet is placed adjacent to a side wall, reinforcement shall be installed on both sides or one side and the back. If reinforcement is installed at the back, it shall be installed between 32 inches (813 mm) and 38 inches (965 mm) above the floor. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height. The backing shall be a minimum of 40 inches (1016 mm) in length.

Reinforcement installed at the side of the water closet shall be installed 32 inches to 38 inches (813 mm to 965 mm) above the floor. The reinforcement shall be installed a maximum of 12 inches (305 mm) from the rear wall and shall extend a minimum of 26 inches (660 mm) in front of the water closet. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height.

3. **Seat height.** The minimum height of water closet seats shall be 15 inches (381 mm) above the floor.

4. **Water closet controls.** Water closet controls shall be mounted no more than 44 inches (1118 mm) above the floor. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

**1134A.8 Lavatories, vanities, mirrors and towel fixtures.** Bathrooms or powder rooms required to be accessible shall have at least one accessible lavatory. Where mirrors and towel fixtures are provided, at least one of each shall be accessible.

1. **Location.** Vanities and lavatories shall be installed with the centerline of the fixture a minimum of 18 inches (457 mm) horizontally from an adjoining wall or fixture to allow for forward approach. When parallel approach is provided, lavatories shall be installed with the centerline of the fixture a minimum of 24 inches (610 mm) horizontally from an adjoining wall or fixture. The top of the fixture rim shall be a maximum of 34 inches (864 mm) above the finished floor.
2. **Floor space.** A clear maneuvering space at least 30 inches by 48 inches (762 mm by 1219 mm) shall be provided at lavatories and shall be centered on the lavatory.
3. **Cabinets.** Cabinets under lavatories are acceptable provided the bathroom has space to allow a parallel approach by a person in a wheelchair and the lavatory cabinets are designed with adaptable knee and toe space.
4. **Knee and toe space.** Knee and toe space shall be provided as follows:
  - 4.1. The knee space shall be at least 30 inches (762 mm) wide and 8 inches (203.2 mm) deep.
  - 4.2. The knee space shall be at least 29 inches (737 mm) high at the front face and reducing to not less than 27 inches (686 mm) at a point 8 inches (203.2 mm) back from the front edge.
  - 4.3. The knee and toe space required in this section shall be provided by one of the following:
    - 4.3.1. The space beneath the lavatory shall be left clear and unobstructed;
    - 4.3.2. Any cabinet beneath the lavatory shall be removable without the use of specialized knowledge or specialized tools; or
    - 4.3.3. Doors to the cabinet beneath the lavatory shall be removable or openable to provide the required unobstructed knee and toe space.
  - 4.4. The toe space required in this section shall be provided as follows:
    - 4.4.1. Shall be at least 30 inches (762 mm) wide and centered on the lavatory.
    - 4.4.2. Shall be at least 17 inches (432 mm) deep, measured from the front edge.
    - 4.4.3. Shall be at least 9 inches (228.6 mm) high from the floor.

5. *Finished floor.* The finished floor beneath the lavatory shall be extended to the wall.
6. *Plumbing protection.* Hot water and drain pipes exposed under lavatories shall be insulated or otherwise covered. There shall be no sharp or abrasive surfaces under lavatories.
7. *Lavatory faucet controls.* Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls shall be no greater than 5 pounds (22.2 N). Lever operated, push-type and electronically controlled mechanisms are examples of acceptable designs. Self-closing valves are allowed if the faucet remains open for at least 10 seconds.

8. *Mirrors and towel fixtures.* Where mirrors or towel fixtures are provided they shall be mounted with the bottom edge no higher than 40 inches (1016 mm) from the floor.

### SECTION 1135A LAUNDRY ROOMS

**1135A.1 General.** If clothes washing machines and clothes dryers are provided in covered multifamily dwelling units, one of each type of appliance shall be provided. Where front-loading clothes washers are not provided, management shall provide assistive devices, on request of the occupant, to permit the use of top-loading clothes washers.

### SECTION 1136A ELECTRICAL RECEPTACLE, SWITCH AND CONTROL HEIGHTS

**1136A.1 Receptacle heights.** Electrical receptacle outlets on branch circuits of 30 amperes or less and communication system receptacles shall be located no more than 48 inches (1219 mm) measured from the top of the receptacle outlet box nor less than 15 inches (381 mm) measured from the bottom of the receptacle outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet), receptacles shall be located within the reach ranges specified in Sec-

tion 1138A.3. Physical barriers and obstructions shall not extend more than 25 inches (635 mm) from the wall beneath the receptacle.

Receptacle outlets that do not satisfy these specifications are acceptable provided that comparable receptacle outlets, that perform the same functions, are provided within the same area and are accessible.

#### Exceptions:

1. Receptacle outlets installed as part of permanently installed baseboard heaters are exempt.
2. Required receptacle outlets shall be permitted in floors when adjacent to sliding panels or walls.
3. Baseboard electrical outlets used in relocatable partitions, window walls or other electrical convenience floor outlets are not subject to the minimum height requirements.
4. This section shall not apply to existing buildings when the enforcing agency determines that compliance with these standards would create an unreasonable hardship.

**1136A.2 Switch and control heights.** Controls or switches intended to be used by the occupant of the room or area to control lighting and receptacle outlets, appliances, alarms or cooling, heating and ventilating equipment shall be located no more than 48 inches (1219 mm) measured from the top of the outlet box nor less than 15 inches (381 mm) measured from the bottom of the outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet) switches and controls shall be located within the reach ranges specified in Section 1138A.3. Physical barriers or obstructions shall not extend more than 25 inches (635 mm) from the wall beneath a control.

Switches and controls that do not satisfy these specifications are acceptable provided that comparable controls or outlets, that perform the same functions, are provided within the same area and are accessible.

**Exception:** Appliances (e.g., kitchen stoves, dishwashers, range hoods, microwave ovens and similar appliances) which have controls located on the appliance.

## Division V – FEATURES COMMON TO EXTERIOR AND INTERIOR OF BUILDINGS

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### SECTION 1137A OTHER FEATURES AND FACILITIES

**1137A.1 General.** This division shall apply to features and facilities of common use areas on accessible floors or sites.

**Note:** The provisions in this division are not applicable to dwelling units, unless otherwise specified.

### SECTION 1138A SPACE ALLOWANCES AND REACH RANGES

#### 1138A.1 Space allowances.

**1138A.1.1 Single wheelchair passage width.** The minimum clear width for single wheelchair passage shall be 36 inches (914 mm) continuously. (See Figure 11A-1E.)

See Section 1113A for minimum clear width of side-walks, and Section 1120A for minimum clear width of interior accessible routes.

**Exception:** 32 inches (813 mm) in width is acceptable at a point not to exceed 24 inches (610 mm) in length. The segments with reduced width shall be separated by segments that are 48 inches (1219 mm) long minimum and 36 inches (914 mm) wide minimum.

**1138A.1.2 Width for two wheelchairs passing.** The minimum width for two wheelchairs to pass is 60 inches (1524 mm) (See Figure 11A-1E).

An accessible route (exterior and interior) with a clear width less than 60 inches (1524 mm) shall provide passing spaces at intervals of 200 feet (60 960 mm) maximum. Passing spaces shall be either: a space 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum; or, an intersection of two walking surfaces providing a T-shaped space complying with Section 1138A.1.3.1, where the base and arms of the T-shaped space extend 48 inches (1219 mm) minimum beyond the intersection. (See Figure 11A-1L.)

**1138A.1.3 Wheelchair turning space.** The space required for a wheelchair to make a 180-degree turn shall be a circular clear space of 60 inches (1524 mm) diameter minimum (See Figure 11A-1D(a)); or a T-shaped space complying with Section 1138A.1.3.1. The circular turning

space shall be permitted to include knee and toe clearance complying with Section 1138A.2

If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be as required in Section 1138A.1.5.

**1138A.1.3.1 T-shaped turning space.** A T-shaped turning space shall be within a 60 inch (1524 mm) square minimum with arms and base 36 inches (914 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction, and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with Section 1138A.2 only at the end of either the base or one arm. (See Figure 11A-1D (b).)

**1138A.1.3.2 Surfaces of turning spaces.** Turning spaces for wheelchairs shall be stable, firm, slip resistant, and shall comply with Section 1110A.3 or Section 1119A.2. Changes in level are not permitted. Slopes not steeper than 1:48 shall be permitted

#### 1138A.1.4 Clear floor or ground space for wheelchairs.

**1138A.1.4.1 Size and approach.** The minimum clear floor or ground space shall be 30 inches by 48 inches (762 mm by 1219 mm). The minimum clear floor or ground space may be positioned for forward or parallel approach to an object (See Figure 11A-1G). Clear floor or ground space may be part of the knee and toe space required under some objects unless otherwise specified.

**1138A.1.4.2 Relationship of maneuvering clearances to wheelchair spaces.** One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin an accessible route or adjoin another wheelchair clear floor space.

If a clear floor space is located in an alcove or otherwise confined on all or a part of three sides, additional maneuvering clearances shall be provided in accordance with the following: (See Figure 11A-1H).

- 1. Forward approach.** Alcoves shall be 36 inches (914 mm) wide minimum when the depth exceeds 24 inches (610 mm).
- 2. Parallel approach.** Alcoves shall be 60 inches (1524 mm) wide minimum when the depth exceeds 15 inches (381 mm)

**1138A.1.4.3 Surfaces of wheelchair spaces.** Clear floor or ground spaces for wheelchairs shall be stable, firm, slip resistant, and shall comply with Section 1110A.3 or Section 1119A.2. Changes in level are not permitted. Slopes not steeper than 1:48 shall be permitted.

**1138A.1.4.3.1 Gratings.** Gratings located in ground and floor surfaces along accessible routes shall be limited to spaces no greater than 1/2-inch (12.7mm) wide in one direction. If gratings have elongated openings, they shall be placed so that the long

dimension is perpendicular to the dominant direction of traffic.

**1138A.1.5 Turn around obstruction.** When the accessible route makes a 180 degree turn around an element which is less than 48 inches (1219 mm) wide, clear width shall be 42 inches (1067 mm) minimum approaching the turn, 48 inches (1219 mm) minimum at the turn and 42 inches (1067 mm) minimum leaving the turn. When the clear width at the turn is 60 inches (1524 mm) minimum, the clear width when approaching and when leaving the turn shall be 36 inches (914 mm) minimum. (See Figure 11A-1C (b).)

When the accessible route makes a 90 degree turn around an element which is more than 48 inches (1219 mm) wide, clear width shall be 36 inches (914 mm) minimum approaching the turn, at the turn and leaving the turn. (See Figure 11A-1C (a).)

**1138A.2 Knee and toe space.** When space beneath an accessible element is included as part of a clear floor space, or turning space, the space shall comply with this section. Additional space shall not be prohibited beneath an element but shall not be considered as part of the clear floor space or turning space. (See Figure 11A-9D.)

**1138A.2.1 Knee space.** Space under an element between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor shall be considered knee space. The knee space shall be clear and unobstructed.

**Exceptions:**

1. For lavatories required to be accessible, the knee space shall be at least 29 inches (737 mm) high at the front face and reducing to not less than 27 inches (686 mm) at a point 8 inches (203.2 mm) back from the front edge.
2. For lavatories and sinks required to be accessible, the dip of the overflow shall not be considered in determining knee and toe clearances.

**1138A.2.1.1 Minimum width.** Knee space shall be 30 inches (762 mm) wide minimum.

**1138A.2.1.2 Maximum depth.** Knee space shall extend 25 inches (635 mm) maximum under an element at 9 inches (229 mm) above the finish floor.

**1138A.2.1.3 Minimum depth.** When knee space is required under an element as part of a clear floor space, the knee space shall be 11 inches (279 mm) deep minimum at 9 inches (229 mm) above the finish floor, and 8 inches (203 mm) deep minimum at 27 inches (686 mm) above the finish floor, measured from the front edge of the element.

**Exceptions:**

1. Combined knee and toe space shall extend 19 inches (483 mm) minimum under sinks required to be accessible.
2. Combined knee and toe space shall extend 19 inches (483 mm) minimum under built-in dining and work surfaces required to be accessible.

**1138A.2.1.4 Clearance reduction.** Between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor, the knee space shall be permitted to be reduced at a rate of 1 inch (25 mm) in depth for each 6 inches (152 mm) in height.

**1138A.2.2 Toe space.** Space under an element between the finish floor and 9 inches (229 mm) above the finish floor shall be considered toe space.

**1138A.2.2.1 Minimum width.** Toe space shall be 30 inches (762 mm) wide minimum.

**1138A.2.2.2 Maximum depth.** Toe space shall extend 25 inches (635 mm) maximum under an element.

**1138A.2.2.3 Minimum depth.** When toe space is required under an element as part of a clear floor space, the toe space shall extend 17 inches (432 mm) minimum under the element, measured from the front edge of the element.

**Exceptions:**

1. Combined knee and toe space shall extend 19 inches (483 mm) minimum under sinks required to be accessible.
2. Combined knee and toe space shall extend 19 inches (483 mm) minimum under built-in dining and work surfaces required to be accessible.

**1138A.2.2.4 Additional clearance.** Space extending greater than 6 inches (152 mm) beyond the available knee space at 9 inches (229 mm) above the finish floor shall not be considered toe space.

**1138A.3 Reach ranges.**

**1138A.3.1 Forward reach.**

1. **Unobstructed.** When the clear floor space allows only forward approach to an object, the maximum high forward reach allowed shall be 48 inches (1219 mm) and the minimum low forward reach shall be no less than 15 inches (381 mm) above the finish floor. (See Figure 11A-II(a).)
2. **Obstructed high reach.** When the high forward reach is over an obstruction, the clear floor space shall extend beneath the element for a distance not less than the reach depth over the obstruction.

The high forward reach shall be 48 inches (1219 mm) maximum when the reach depth is 20 inches (508 mm) maximum. When the reach depth exceeds 20 inches (508 mm), but is not more than 25 inches (635 mm), the high forward reach shall be 44 inches (1118 mm) maximum. (See Figure 11A-II(b).)

**1138A.3.2 Side reach.**

1. **Unobstructed.** When a clear floor space allows a parallel approach to an element, and the side reach is unobstructed, the high side reach shall be 48 inches (1219 mm) maximum, and the low side reach shall be 15 inches (381 mm) minimum

above the finish floor. (See Figures 11A-1J(a) and 11A-1J(b))

**Exceptions:**

1. An obstruction shall be permitted between the clear floor space and the element when the depth of the obstruction is 10 inches (254 mm) maximum.
2. Bookshelves shall be permitted to be 54 inches (1372 mm) maximum above the finish floor. Bookshelves may be greater than 54 inches (1372 mm) above the finish floor when an attendant is available to assist persons with disabilities.
2. **Obstructed high reach.** When a clear floor space allows a parallel approach to an element and the high side reach is over an obstruction, the height of the obstruction shall be 34 inches (864 mm) maximum and the depth of the obstruction shall be 24 inches (610 mm) maximum.

The high side reach shall be 48 inches (1219 mm) maximum for a reach depth of 10 inches (254 mm) maximum. When the reach depth exceeds 10 inches (254 mm), but no more than 24 inches (610 mm), the high side reach shall be 46 inches (1168 mm) maximum. (See Figure 11A-1J(c).)

**Exception:** The top of washing machines and clothes dryers shall be permitted to be 36 inches (914 mm) maximum above the finish floor.

**1138A.4 Controls and operating mechanisms.**

**Note:** See also Section 1142A for receptacle, switch and control installation.

**1138A.4.1 General.** Controls and operating mechanisms in accessible spaces, along accessible routes or as part of accessible elements shall comply with this section.

**1138A.4.2 Clear floor space.** Clear floor space complying with Section 1138A.1.4 that allows a forward or parallel approach by a person using a wheelchair shall be provided at all controls and operating mechanisms.

**1138A.4.3 Height.** Controls and operating mechanisms shall be located no higher than 48 inches (1219 mm), and no lower than 15 inches (381 mm), above the finished floor measured to the center of the grip. If the reach is over an obstruction (for example, washer or dryer), controls and operating mechanisms shall be located within the reach ranges specified in Section 1138A.3. Controls and operating mechanisms that do not satisfy these specifications are acceptable, provided that comparable mechanisms, controls or outlets, that perform the same functions, are provided within the same area and are accessible.

**1138A.4.4 Operation.** Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls and operating mechanisms shall be no greater than 5 pounds (22.2 N).

**SECTION 1139A  
ACCESSIBLE DRINKING FOUNTAINS**

**1139A.1 General.** Drinking fountains and water coolers in common use areas and/or sites shall comply with this section. A side approach drinking fountain is not acceptable. (See Figure 11A-11A.)

**1139A.2 Accessible route.** Drinking fountains and water coolers shall be on an accessible route.

**1139A.3 Depth.** Drinking fountains shall be a minimum of 18 inches (457 mm) and a maximum of 19 inches (483 mm) in depth.

**1139A.4 Clear floor space.** Drinking fountains shall be provided with 30 inches by 48 inches (762 mm by 1219 mm) clear floor space, centered on the unit. The clear floor space shall be positioned for a forward approach.

**1139A.4.1 Knee and toe space.** Drinking fountains shall be provided with a clear and unobstructed knee and toe space. Knee and toe space shall comply with Section 1138A.2.

**1139A.5 Spout location.** The spout shall be located 15 inches (381 mm) minimum from the vertical support and 5 inches (127 mm) maximum from the front edge of the drinking fountain, including bumpers. Spout outlets shall be 36 inches (914 mm) maximum above the finish floor.

**1139A.6 Water flow.** The spout shall provide a flow of water at least 4 inches (101.6 mm) high to allow the insertion of a cup or glass under the flow of water. The angle of the water stream shall be measured horizontally relative to the front face of the unit. When spouts are located less than 3 inches (76 mm) from the front of the unit, the angle of the water stream shall be 30 degrees maximum. When spouts are located between 3 inches (76 mm) and 5 inches (127 mm) maximum from the front of the unit, the angle of the water stream shall be 15 degrees maximum.

**1139A.7 Controls and operating mechanisms.** The flow of water shall be activated by manually or electronically operated controls. The manually operated controls shall be front mounted or side mounted, located within 6 inches (152 mm) of the front edge of the fountain. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

**1139A.8 Location.** Drinking fountains shall be located completely within alcoves, between wing walls or otherwise positioned so as not to encroach into pedestrian ways. The alcove or otherwise protected area in which the drinking fountain is located shall not be less than 32 inches (813 mm) in width and 18 inches (457 mm) in depth. When the depth of the protected area where the drinking fountain is located exceeds 24 inches (610 mm), additional maneuvering clearance shall be provided in accordance with Section 1138A.1.4.2 and Figure 11A-1H.

When provided, wing walls shall project out from the supporting wall at least as far as the drinking fountain to within 6 inches (152.4 mm) vertically from the finish floor.

Protruding objects located in alcoves or otherwise positioned so as to limit encroachment into pedestrian ways are permitted to project 4 inches (101.6 mm) into walks, halls, corridors, passageways or aisles. (See Figure 11A-11A.)

## SECTION 1140A ACCESSIBLE TELEPHONES

**1140A.1 General.** If public telephones are provided, they shall comply with this section. On floors where public telephones are provided, at least one telephone shall be accessible. On any floor where two or more banks of multiple telephones are provided, at least one telephone in each bank shall be accessible.

**1140A.2 Clear floor or ground space.** A clear floor or ground space at least 30 inches by 48 inches (762 mm by 1219 mm) that allows either a forward or parallel approach by a person using a wheelchair shall be provided at telephones. Bases, enclosures and fixed seats shall not impede approaches to telephones by people who use wheelchairs. (See Figure 11A-11B).

The minimum clear floor or ground space for wheelchairs may be positioned for forward or parallel approach to an object. Clear floor or ground space for wheelchairs may be part of the knee space required under some objects.

**1140A.3 Relationship of maneuvering clearances to wheelchair spaces.** One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin another wheelchair clear floor space. If a clear floor space is located in an alcove or otherwise confined on all or part of three sides, additional maneuvering clearances shall be provided.

**1140A.4 Mounting height.** The highest operable part of the telephone shall be within the reach ranges specified in Figure 11A-11B. Telephones mounted diagonally in a corner that require wheelchair users to reach diagonally shall have the highest operable part no higher than 54 inches (1372 mm) above the floor. (See Figure 11A-11B).

**1140A.5 Enclosures.** If telephone enclosures are provided, they may overhang the clear floor space required in Sections 1140A.2 and 1140A.3 with the following limits:

1. **Side reach possible.** The overhang shall be no greater than 19 inches (483 mm). The height of the lowest overhanging part shall be equal to or greater than 27 inches (686 mm) above the floor.
2. **Full-height enclosures.** Entrances to full-height enclosures shall be a minimum of 30 inches (762 mm) in width.
3. **Forward reach required.** If the overhang is greater than 12 inches (305 mm), then the clear width of the enclosure shall be 30 inches (762 mm) minimum; if the clear width of the enclosure is less than 30 inches (762 mm), then the height of the lowest overhanging part shall be equal to or greater than 27 inches (686 mm).

**1140A.6 Equipment for hearing impaired people.** Telephones shall be equipped with a receiver that generates a magnetic field in the area of the receiver cap. A reasonable number of the public telephones provided, but always at least

one on each floor or in each bank, whichever is more, in a building or facility, shall be equipped with a volume control. Such telephones shall be capable of a minimum of 12 dbA and a maximum of 18 dbA above normal. If an automatic reset is provided, 18 dbA may be exceeded. Public telephones with volume control shall be hearing aid compatible and shall be identified by a sign containing a depiction of a telephone handset with radiating sound waves. (See Figure 11A-11D).

**1140A.7 Text telephones.** If a total of four or more public pay telephones are provided at the interior and exterior of a site, and if at least one of the total number provided is located in an interior location, at least one interior public text telephone shall be provided.

**1140A.7.1 Signage.** Text telephones shall be identified by the International TTY symbol (see Figure 11A-11C). If a facility has a public text telephone, directional signage indicating the location of the nearest such telephone shall be placed adjacent to all banks of telephones that do not contain a text telephone. Such directional signage shall include the International TTY symbol. If a facility has no banks of telephones, the directional signage shall be provided at the entrance or in a building directory.

**1140A.8 Controls.** Telephones shall have push-button controls where service for such equipment is available.

**1140A.9 Cord length.** The cord from the telephone to the handset shall be at least 29 inches (737 mm) long.

**1140A.10 Telephone books.** If telephone books are provided, they shall be located in a position that complies with the reach ranges in Figures 11A-II and 11A-IJ.

## SECTION 1141A ACCESSIBLE SWIMMING POOLS

**1141A.1 General.** Swimming pools in common use areas shall comply with the provisions of this section and Chapter 31B.

**1141A.2 Swimming pool deck areas.** Swimming pool deck areas must be accessible, and a mechanism to assist persons with disabilities gain entry into the pool and exit from the pool shall be provided. Such a mechanism may consist of a swimming pool lift device as long as the device meets all of the following criteria:

1. Has a seat that meets all of the following:
  - 1.1. The seat must be rigid;
  - 1.2. The seat must be not less than 17 inches (432 mm) and not more than 19 inches (483 mm), inclusive of any cushioned surface that might be provided, above the pool deck;
  - 1.3. The seat must have two armrests. The armrest on the side of the seat by which access is gained shall be either removable or fold clear of the seat;
  - 1.4. The seat must have a back support that is at least 12 inches (305 mm) tall; and



- 1.5. The seat must have an occupant restraint for use by the occupant of the seat and the restraint must meet the standards for operable controls in compliance with Section 1138A.4.4.
2. Be capable of unassisted operation from both the deck and water levels.
3. Be stable and not permit unintended movement when a person is getting into or out of the seat.
4. Be designed to have a live-load capacity of not less than 300 pounds.
5. Be positioned so that, if the pool has water of different depths, it will place the operator into water that is at least 3 feet (914 mm) deep.
6. Be capable of lowering the operator at least 18 inches (457 mm) below the surface of the water.

#### SECTION 1142A ELECTRICAL RECEPTACLE, SWITCH AND CONTROL HEIGHTS

**1142A.1 Receptacle heights.** Electrical receptacle outlets on branch circuits of 30 amperes or less and communication system receptacles shall be located no more than 48 inches (1219 mm) measured from the top of the receptacle outlet box nor less than 15 inches (381 mm) measured from the bottom of the receptacle outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet), receptacles shall be located within the reach ranges specified in Section 1138A.3. Physical barriers and obstructions shall not extend more than 25 inches (635 mm) from the wall beneath the receptacle.

Receptacle outlets that do not satisfy these specifications are acceptable provided that comparable receptacle outlets, that perform the same functions, are provided within the same area and are accessible.

##### Exceptions:

1. Receptacle outlets installed as part of permanently installed baseboard heaters are exempt.
2. Required receptacle outlets shall be permitted in floors when adjacent to sliding panels or walls.
3. Baseboard electrical outlets used in relocatable partitions, window walls or other electrical convenience floor outlets are not subject to the minimum height requirements.
4. This section shall not apply to existing buildings when the enforcing agency determines that compliance with these standards would create an unreasonable hardship.

**1142A.2 Switch and control heights.** Controls or switches intended to be used by the occupant of the room or area to control lighting and receptacle outlets, appliances, alarms or cooling, heating and ventilating equipment shall be located no more than 48 inches (1219 mm) measured from the top of the outlet box nor less than 15 inches (381 mm) measured

from the bottom of the outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet), switches and controls shall be located within the reach ranges specified in Section 1138A.3. Physical barriers or obstructions shall not extend more than 25 inches (635 mm) from the wall beneath a switch or control.

Switches and controls that do not satisfy these specifications are acceptable provided that comparable controls or outlets, that perform the same functions, are provided within the same area and are accessible.

#### SECTION 1143A SIGNAGE

**1143A.1 General.** When signs and/or identification devices are provided they shall comply with this section.

When both visual and tactile characters are required, either one sign with both visual and tactile characters, or two separate signs - one with visual, and one with tactile characters, shall be provided.

**Exception:** Signs need not be provided within dwelling units.

**Note:** See Section 1127A.7 for additional signage requirements applicable to sanitary facilities, and Section 1124A for additional signage requirements applicable to elevators.

**1143A.2 Identification signs.** When signs identify permanent rooms and spaces of a building or site, they shall comply with Sections 1143A.1, 1143A.5, 1143A.6 and 1143A.7.

**Exception:** Exterior signs that are not located at the door to the space they serve shall not be required to comply with Section 1143A.6.

**1143A.3 Directional and informational signs.** When signs direct to or give information about permanent rooms and spaces of a building or site, they shall comply with Sections 1143A.5.

**1143A.4 Accessibility signs.** When signs identify, direct or give information about accessible elements and features of a building or site, they shall include the appropriate symbol of accessibility and shall comply with Section 1143A.5.

**1143A.5 Visual characters.** Signs with visual characters shall comply with this section.

1. **Finish and contrast.** Characters and their background shall have a non-glare finish. Characters shall contrast with their background, either light on a dark background or dark on a light background.
2. **Character type.** Characters shall be uppercase, lowercase or a combination of both. Characters shall be conventional in form, and shall not be italic, oblique, script, highly decorative, or of other unusual forms.
3. **Proportions.** Characters on signs shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I".

**TABLE 1143A.5  
VISUAL CHARACTER HEIGHT**

HEIGHT TO FINISH FLOOR FROM BASELINE OF CHARACTER	HORIZONTAL VIEWING DISTANCE	MINIMUM CHARACTER HEIGHT
40 inches (1016 mm) to less than or equal to 70 inches (1778 mm)	Less than 72 inches (1829 mm)	$\frac{5}{8}$ inch (15.9 mm)
	72 inches (1829 mm) and greater	$\frac{5}{8}$ inch (15.9 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 72 inches (1829 mm)
Greater than 70 inches (1778 mm) to less than or equal to 120 inches (3048 mm)	Less than 180 inches (4572 mm)	2 inches (51 mm)
	180 inches (4572 mm) and greater	2 inches (51 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 180 inches (4572 mm)
Greater than 120 inches (3048 mm)	Less than 21 feet (6401 mm)	3 inches (76 mm)
	21 feet (6401 mm) and greater	3 inches (76 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 21 feet (6401 mm)

4. **Character height.** Visual characters shall be sized in accordance with Table 1143A.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the uppercase letter "I".

5. **Height from finish floor.** Visual characters shall be 40 inches (1016 mm) minimum above the finish floor.

**Exceptions:**

1. Visual characters indicating elevator car controls.
2. Floor-level exit signs complying with Chapter 10, Section 1011.6.

6. **Stroke thickness.** Stroke thickness of the uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character.

7. **Character spacing.** Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of character height.

8. **Line spacing.** Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height.

9. **Character format.** Text shall be in a horizontal format.

**1143A.6 Raised characters and pictorial symbol signs.** When raised characters are required or when pictorial symbols (pictograms) are used on such signs, they shall comply with this section. Raised characters and pictorial symbols shall be duplicated in Braille complying with Section 1143A.7.

1. **Character type.** Raised characters on signs shall be  $\frac{1}{32}$  inch (0.8 mm) minimum above their background. Characters shall be sans serif uppercase, and shall not be italic, oblique, script, highly decorative, or of other unusual forms.
2. **Character height.** Character height measured vertically from the baseline of the character shall be  $\frac{5}{8}$

inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "I".

3. **Character format.** Characters and Braille shall be in a horizontal format.

4. **Proportions.** Raised characters on signs shall be selected from fonts when the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I".

5. **Stroke thickness.** Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character.

6. **Character spacing.** Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. When characters have rectangular cross sections, spacing between individual raised characters shall be  $\frac{1}{8}$  inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. When characters have other cross sections, spacing between individual raised characters shall be  $\frac{1}{16}$  inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and  $\frac{1}{8}$  inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements  $\frac{3}{8}$  inch (9.5 mm) minimum.

7. **Line spacing.** Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

8. **Location.** When a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. When a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. When a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door. When there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located

on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (457 mm) minimum by 18 inches (457 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. When permanent identification signage is provided for rooms and spaces they shall be located on the approach side of the door as one enters the room or space. Signs that identify exits shall be located on the approach side of the door as one exits the room or space.

9. **Height.** Signs with raised characters shall be located 48 inches (1219 mm) minimum above the finish floor, measured from the baseline of the lowest Braille cells and 60 inches (1524 mm) maximum above the finish floor, measured from the baseline of the highest line of raised characters.

**Exception:** Tactile characters for elevator car controls shall not be required to comply with this section.

10. **Pictorial symbol signs (pictograms).** Pictorial symbol signs (pictograms) shall be accompanied by a text description located directly below the pictogram field. The text description shall comply with Sections 1143A.6 and 1143A.7. The outside dimension of the pictogram field shall be a minimum of 6 inches (152 mm) in height. Characters and Braille shall not be located in the pictogram field.

**1143A.7 Braille.** Contracted Grade 2 Braille shall be used wherever Braille is required in other portions of these standards.

**1143A.7.1 Dimensions and capitalization.** Braille dots shall have a domed or rounded shape and shall comply with Table 1143A.7.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

**TABLE 1143A.7.1 BRAILLE DIMENSIONS**

MEASUREMENT RANGE	MINIMUM IN INCHES MAXIMUM IN INCHES
Dot base diameter	0.059 (1.5 mm) to 0.063 (1.6 mm)
Distance between two dots in the same cell <sup>1</sup>	0.100 (2.5 mm)
Distance between corresponding dots in adjacent cells <sup>1</sup>	0.300 (7.6 mm)
Dot height	0.025 (0.6 mm) to 0.037 (0.9 mm)
Distance between corresponding dots from one cell directly below <sup>1</sup>	0.395 (10 mm) to 0.400 (10.2 mm)

1. Measured center to center.

**1143A.7.2 Position.** Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multi-lined, braille shall be placed below the entire text. Braille shall be separated  $\frac{3}{8}$  inch (9.5 mm) minimum and  $\frac{1}{2}$  inch (12.7 mm) maximum from any other tactile characters and  $\frac{3}{8}$  inch (9.5 mm) minimum from raised borders and decorative elements.

**Exception:** Braille provided on elevator car controls shall be separated  $\frac{3}{16}$  inch (4.8 mm) minimum and shall be located directly below the corresponding raised characters or symbols.

**1143A.8 Symbols of accessibility.** Symbols of accessibility and their background shall have a non-glare finish. Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background. Symbols of accessibility shall comply with the following:

1. **International Symbol of Accessibility.** The International Symbol of Accessibility shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B. (See Figure 11A-1A.)
2. **International Symbol of TTY.** (See Figure 11A-11C.)
3. **Volume Control Telephones.** (See Figure 11A-11D.)
4. **Assistive Listening Systems.** (See Figure 11A-11E.)
5. **Cleaner Air Symbol.** (See Chapter 11B.)
6. **Toilet and Bathing Facilities Geometric Symbols.** (See Section 1127A.7.)

## SECTION 1144A Reserved

## SECTION 1145A Reserved

## SECTION 1146A Reserved

## SECTION 1147A Reserved

## SECTION 1148A Reserved

## SECTION 1149A Reserved

**Division VI – SITE IMPRACTICALITY TESTS****Division VI Table of Contents**

Section 1150A Site Impracticability Tests

Test No. 1—Individual Building Test

Test No. 2—Site Analysis Test

Test No. 3—Unusual Characteristics Test

**SECTION 1150A**  
**SITE IMPRACTICALITY TESTS**

**1150A.1 General.** Covered multifamily dwellings in buildings without an elevator, located on sites with difficult terrain conditions or unusual characteristics, may employ the site impracticability tests in this division for determining the accessibility and adaptability provisions required by this chapter.

Except as provided for in Section 1102A.3.1, the provisions of this section do not apply to multistory dwelling units in nonelevator buildings.

**SINGLE BUILDING WITH**  
**ONE COMMON (LOBBY) ENTRANCE**

The following may only be used for determining required access to covered multifamily dwelling units, in a single building with one common (lobby) entrance, located on a site with difficult terrain conditions or unusual characteristics:

All ground floor units in nonelevator buildings shall be adaptable and on an accessible route unless an accessible route to the common (lobby) entrance is not required as determined by Test No. 1, Individual Building Test, or Test No. 3, Unusual Characteristics Test, as described in this section.

Sites where either Test No. 1 or Test No. 3 is used and it is determined that an accessible route to the common (lobby) entrance is not required, at least 20 percent of the ground floor dwelling units shall comply with Division IV, and all remaining ground floor dwelling units shall comply with the features listed in Section 1150A.2 unless exempted by Test No. 3, Unusual Characteristics Test.

Test No. 1—Individual Building Test may only be used if the site has terrain over 15 percent slope.

Test No. 3—Unusual Characteristics Test may be used if applicable.

**Provisions to Test Nos. 1 and 2.** Where a building elevator is provided only as means of creating an accessible route to covered multifamily dwelling units on a ground floor, the building is not considered to be an elevator building for purposes of this code; hence, only the ground floor dwelling units would be covered.

**TEST NO. 1—INDIVIDUAL BUILDING TEST**

It is not required by this code to provide an accessible route when the terrain of the site is such that both of the following apply:

1. The slopes of the undisturbed site measured between the planned entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance exceed 15 percent; and
2. The slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance also exceed 15 percent.

If there are no vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance, the slope for the purposes of Test No. 1 will be measured to the closest vehicular or pedestrian arrival point.

For purposes of these requirements, vehicular or pedestrian arrival points include public or resident parking areas, public transportation stops, passenger loading zones and public streets or sidewalks. To determine site impracticability, the slope would be measured at ground level from the point of the planned entrance on a straight line to (1) each vehicular or pedestrian arrival point that is within 50 feet (15 240 mm) of the planned entrance, or (2) if there are no vehicular or pedestrian arrival points within the specified area, the vehicular or pedestrian arrival point closest to the planned entrance. In the case of sidewalks, the closest point to the entrance will be where a public sidewalk entering the site intersects with the walk to the entrance. In the case of resident parking areas, the closest point to the planned entrance will be measured from the entry point to the parking area that is located closest to the planned entrance.

**TEST NO. 2—SITE ANALYSIS TEST**

For a site having multiple buildings, or a site with a single building with multiple entrances, it is not required to provide an accessible route to all ground floor units under the following conditions:

1. Calculate the percentage of the total buildable area of the undisturbed site with a natural grade less than 10-percent slope. The analysis of the existing slope (before grading) shall be done on a topographic survey with 2-foot (610 mm) contour intervals with slope determination made between each successive interval. The accuracy of the slope analysis shall be certified by a licensed engineer, landscape architect, architect or surveyor.
2. Determine the requirement of providing an accessible route to planned multifamily dwellings based on the topography of the existing natural terrain. The minimum percentage of ground floor units required

*on an accessible route shall equal the percentage of the total buildable area (not restricted-use areas) of the undisturbed site with an existing natural grade of less than 10-percent slope. In no case shall less than 20 percent of the ground floor dwelling units be on an accessible route and comply with the provisions of Division IV.*

3. *In addition to the percentage established in paragraph (2), all additional ground floor units in a building, or ground floor units served by a particular entrance, that fall within an 8.33-percent slope between their planned entrances and an arrival point shall be on an accessible route and comply with the provisions of Division IV.*
4. *All additional ground floor units in a building, or ground floor units served by a particular entrance, not on an accessible route shall comply with the features listed in Section 1150A.2.*

8. *Lighting and environmental control height: see Section 1136A.*
9. *Faucet controls: see Section 1134A.8, Item 7.*
10. *Water closet, bathtub and lavatory minimum space requirements: see Section 1134A.*
11. *Removable cabinets under the kitchen sink counter area: see Section 1133A.3.*

### **TEST NO. 3—UNUSUAL CHARACTERISTICS TEST**

*Unusual characteristics include sites located in a state or federally designated floodplain or coastal high-hazard areas and sites subject to other similar requirements of law or code that require the lowest floor or the lowest structural member of the lowest floor to be designed to a specified level at or above the base flood elevation. An accessible route to a building entrance is impractical due to unusual characteristics of the site when:*

1. *The original site characteristics result in a difference in finished grade elevation exceeding 30 inches (762 mm) and 10 percent measured between an entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance; or*
2. *If there are no vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance, the unusual characteristics result in a difference in finished grade elevation exceeding 30 inches (762 mm) and 10 percent measured between an entrance and the closest vehicular or pedestrian arrival point.*

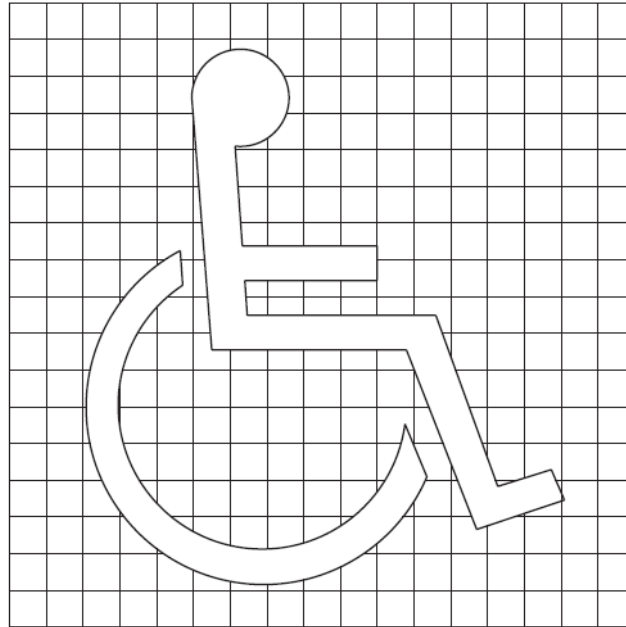
#### **1150A.2 Additional requirements for Section 1150A.**

*All other ground floor dwelling units in nonelevator buildings shall be made to comply with the following requirements:*

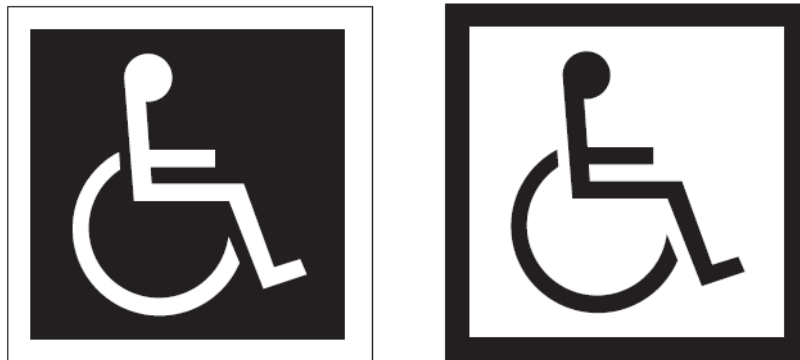
1. *Grab bar reinforcement: see Section 1134A.*
2. *Thirty-two inch (813 mm) clear door interior opening width: see Section 1132A.3.*
3. *Lever hardware: see Section 1132A.8.*
4. *Door signal devices: see Section 1132A.10.*
5. *Clear space by doors: see Chapters 10 and 11A.*
6. *Minimum 15-inch (381 mm) water closet seat height: see Section 1134A.7, Item 3.*
7. *Electrical receptacle outlet height: see Section 1136A.*

**Division VII – FIGURES**

*Diagrams illustrate the specific requirements of these regulations and are intended only as an aid for building design and construction. Diagrams are not to scale.*



**(a) SYMBOL PROPORTIONS**



**(b) DISPLAY CONDITIONS**

**FIGURE 11A-1A  
INTERNATIONAL ACCESSIBILITY SYMBOL**

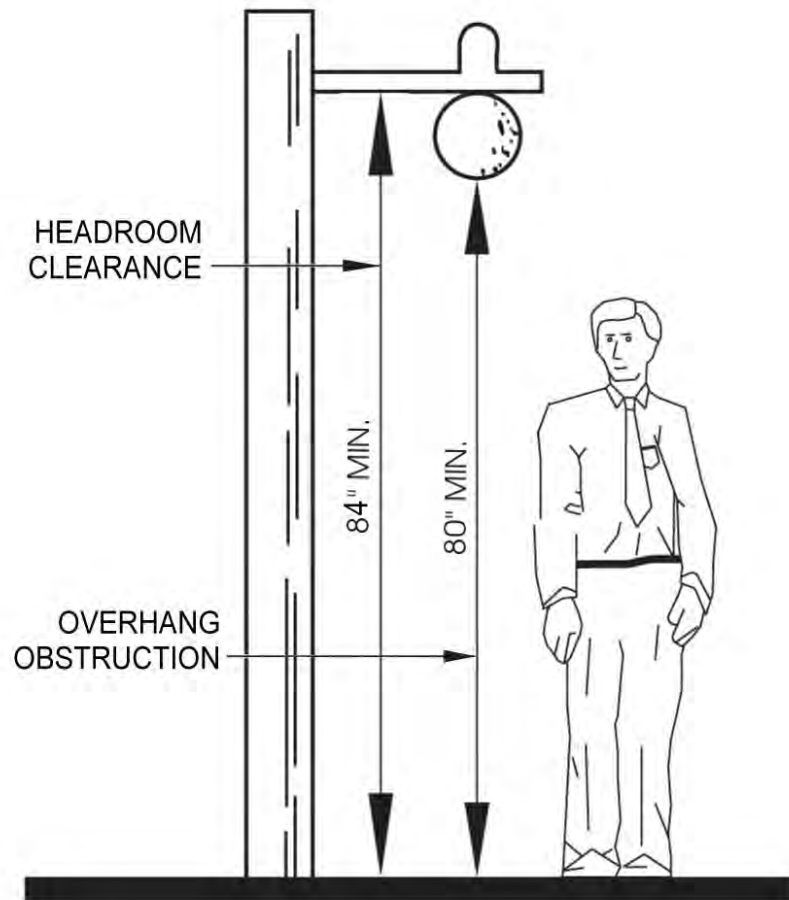
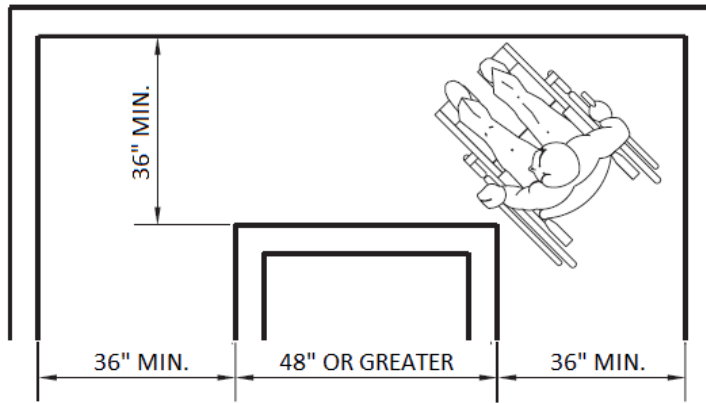
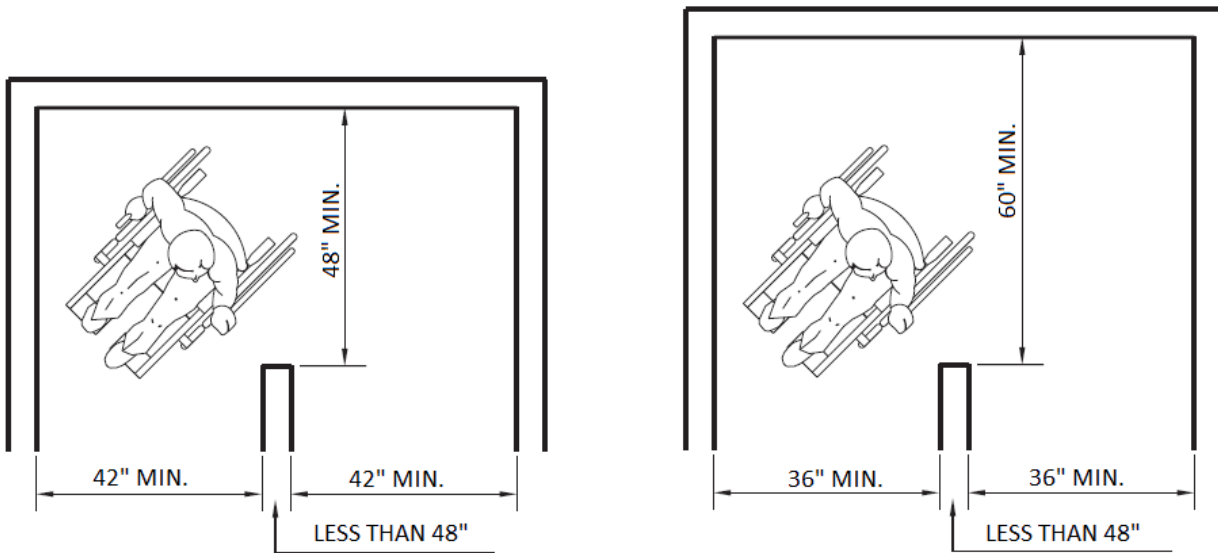


FIGURE 11A-1B  
HEADROOM CLEARANCE AND OVERHANGING OBSTRUCTION



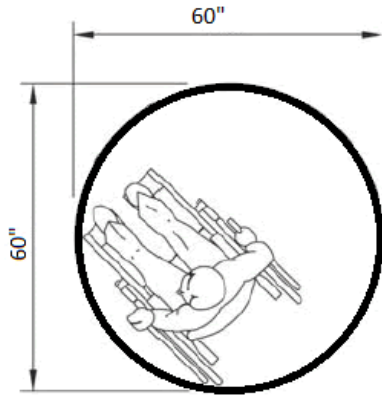
(a) 90° TURN AROUND OBSTRUCTION



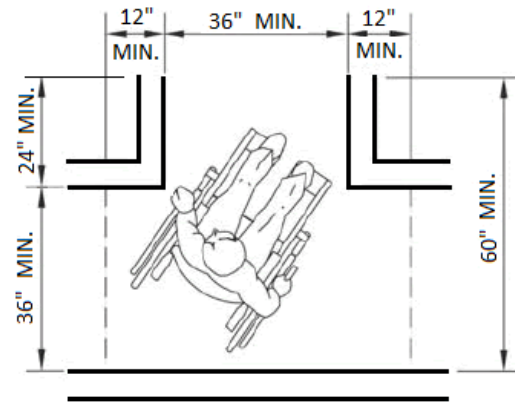
(b) 180° TURN AROUND OBSTRUCTION

FIGURE 11A-1C  
WIDTH OF ACCESSIBLE ROUTE AT TURNS

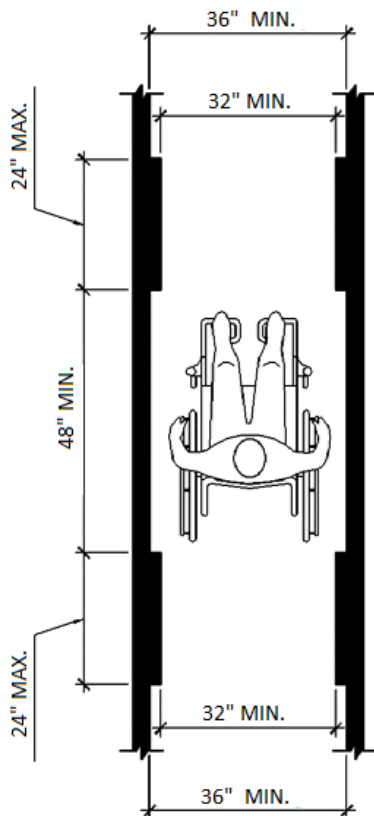




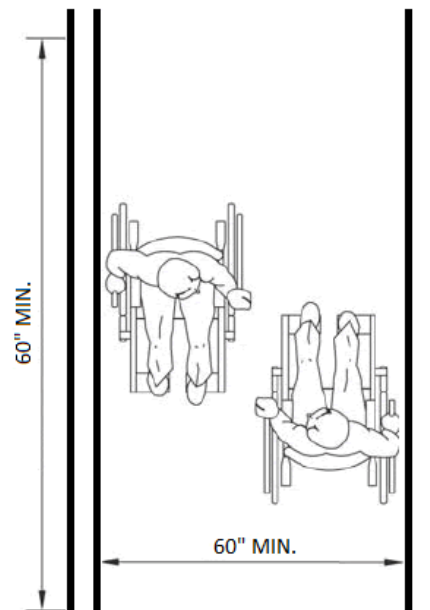
(a) 60 INCHES DIAMETER SPACE



(b) T-SHAPED SPACE FOR 180 ° TURN

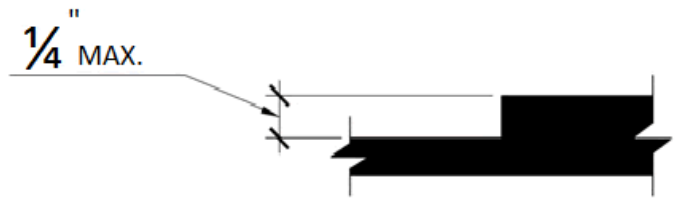
FIGURE 11A-1D  
WHEELCHAIR TURNING SPACE

MINIMUM CLEAR WIDTH FOR SINGLE WHEELCHAIR

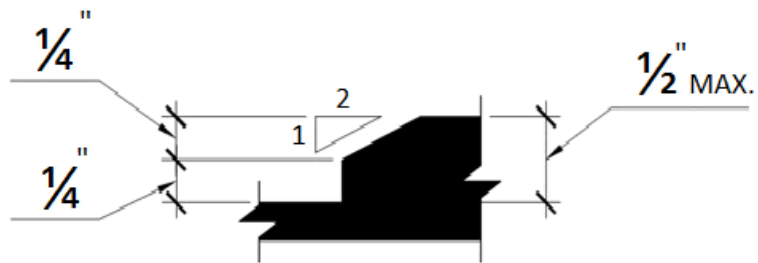


MINIMUM CLEAR WIDTH FOR TWO WHEELCHAIRS

FIGURE 11A-1E  
WHEELCHAIR PASSAGE WIDTH

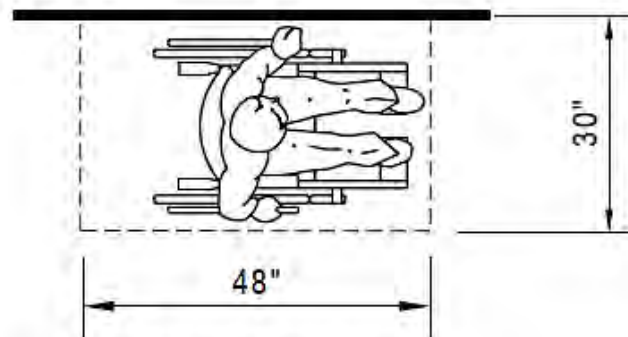


(a) VERTICAL CHANGE IN LEVEL

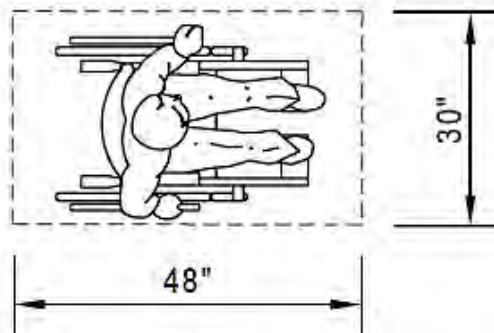


(b) BEVELED CHANGE IN LEVEL

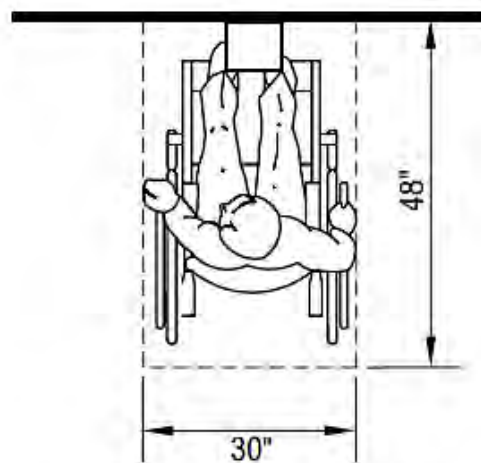
FIGURE 11A-1F  
CHANGE IN LEVEL



**(a) PARALLEL APPROACH**

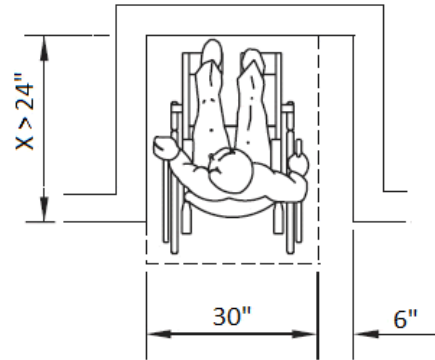
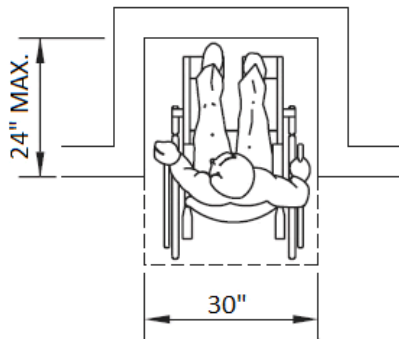


**(b) CLEAR FLOOR SPACE**



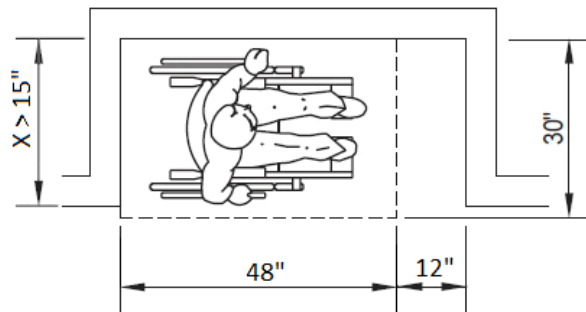
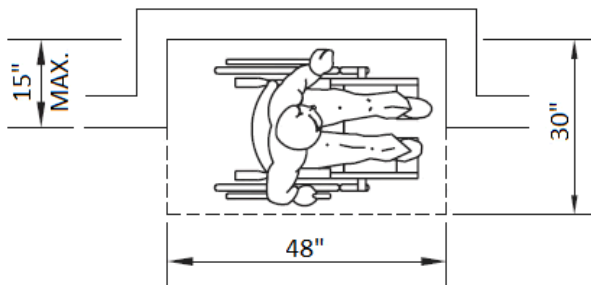
**(c) FORWARD APPROACH**

**FIGURE 11A-1G  
MINIMUM CLEAR FLOOR SPACE FOR WHEELCHAIRS**



IF  $X > 24"$ , ADDITIONAL MANEUVERING  
CLEARANCE OF 6" SHALL BE PROVIDED.

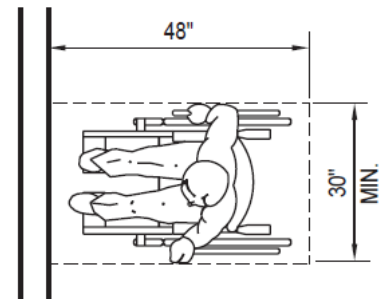
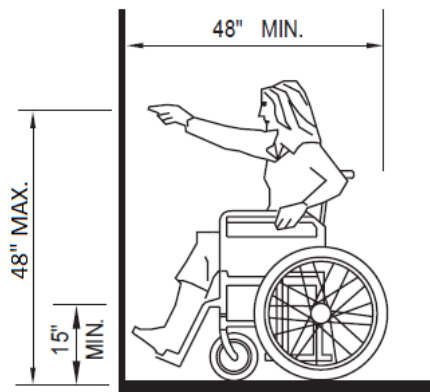
(a) FORWARD APPROACH



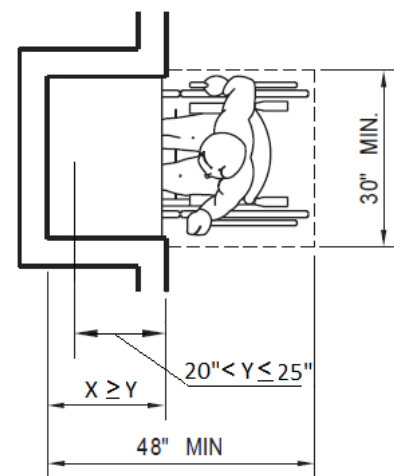
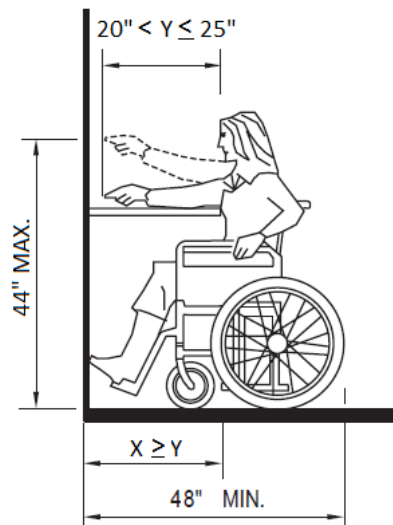
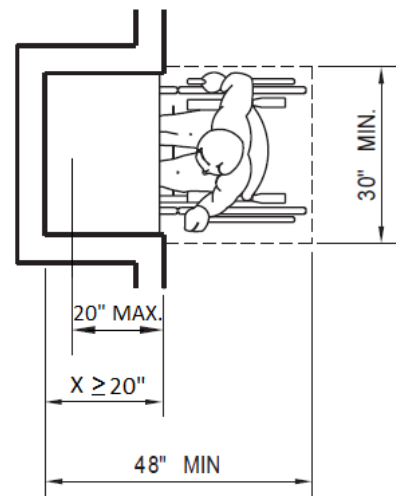
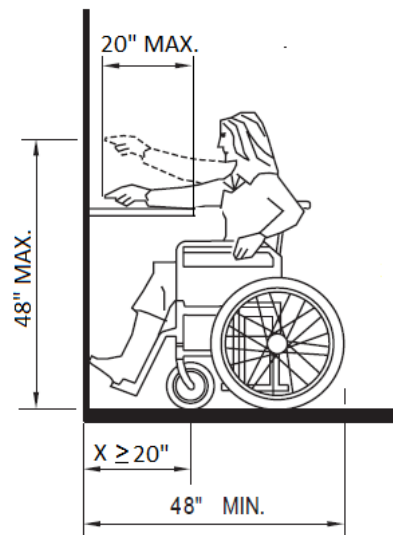
IF  $X > 15"$ , ADDITIONAL MANEUVERING  
CLEARANCE OF 12" SHALL BE PROVIDED.

(b) PARALLEL APPROACH

FIGURE 11A-1H  
MINIMUM CLEAR FLOOR SPACE IN ALCOVES

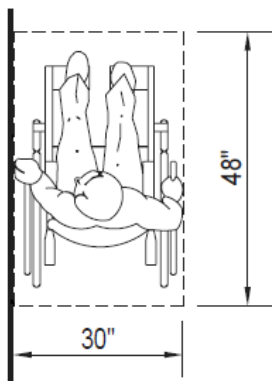


(a) UNOBSTRUCTED FORWARD REACH

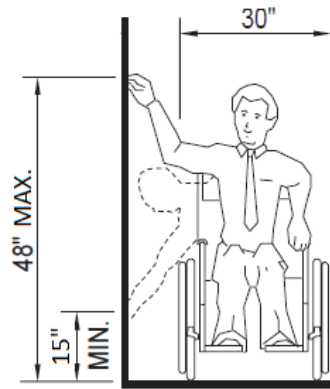


(b) FORWARD REACH OVER OBSTRUCTION

FIGURE 11A-11  
FORWARD REACH

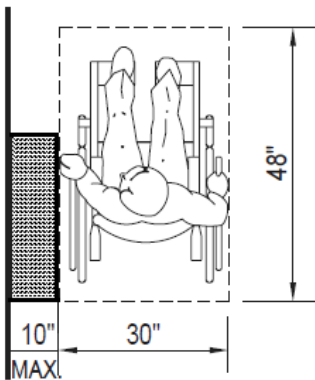


CLEAR FLOOR SPACE FOR PARALLEL APPROACH

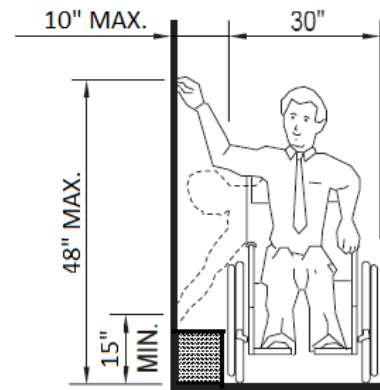


HIGH AND LOW SIDE REACH LIMITS

**(a) UNOBSTRUCTED SIDE REACH**

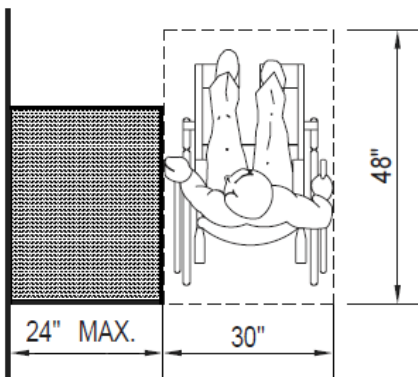


CLEAR FLOOR SPACE FOR PARALLEL APPROACH

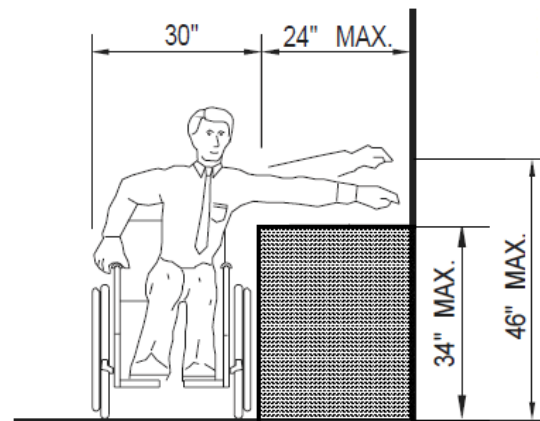


HIGH AND LOW SIDE REACH LIMITS

**(b) SIDE REACH OVER OBSTRUCTION 10" MAXIMUM**



CLEAR FLOOR SPACE FOR PARALLEL APPROACH



MAXIMUM SIDE REACH OVER OBSTRUCTION

**(c) SIDE REACH OVER OBSTRUCTION 10" MINIMUM AND 24" MAXIMUM**

FIGURE 11A-1J  
SIDE REACH

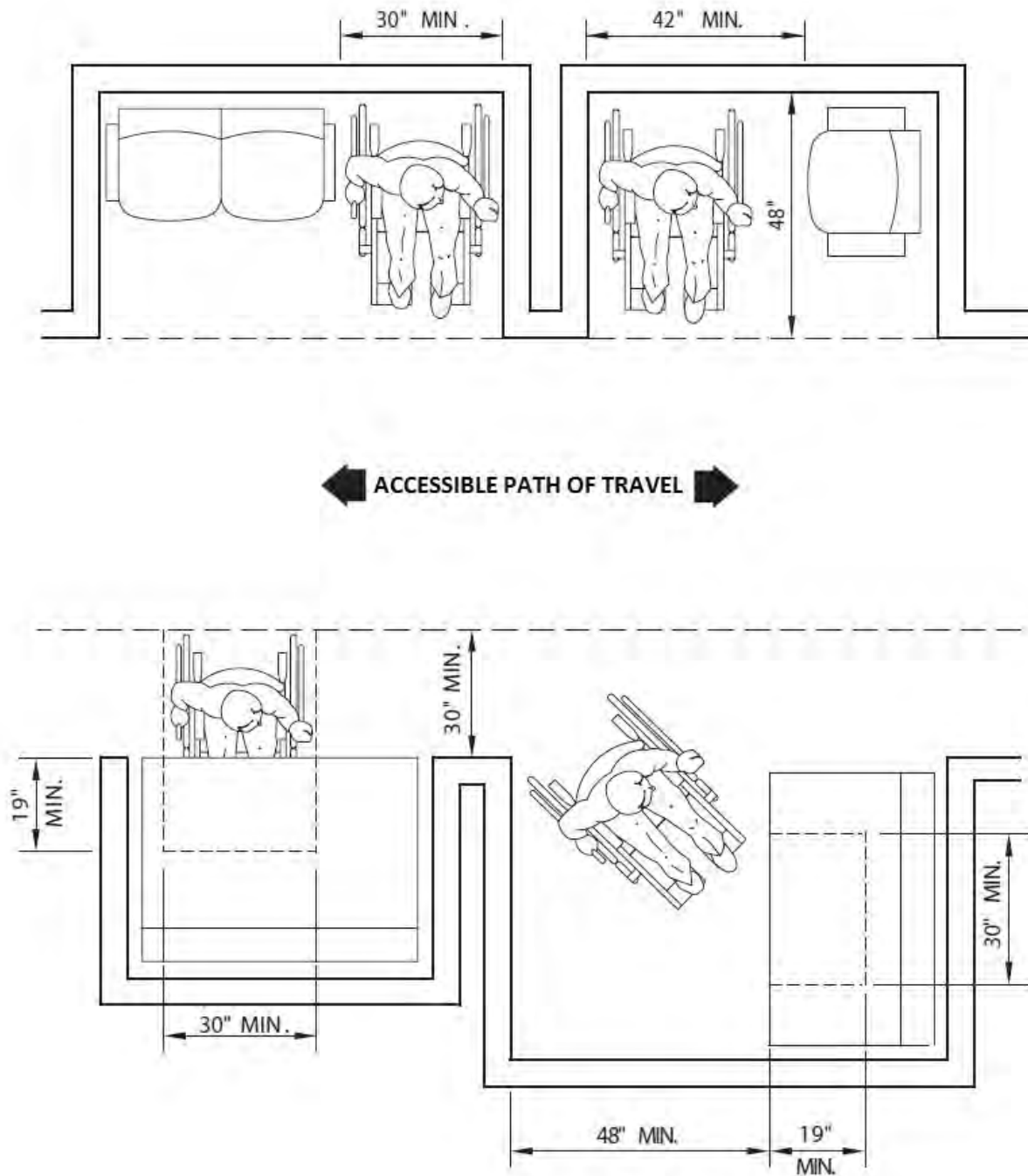
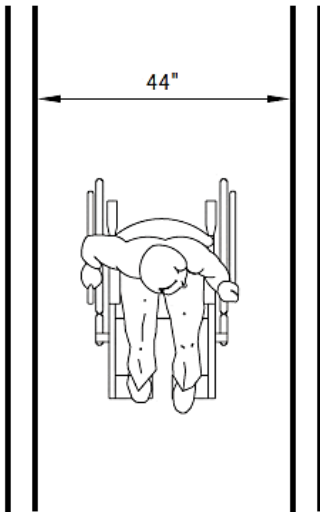
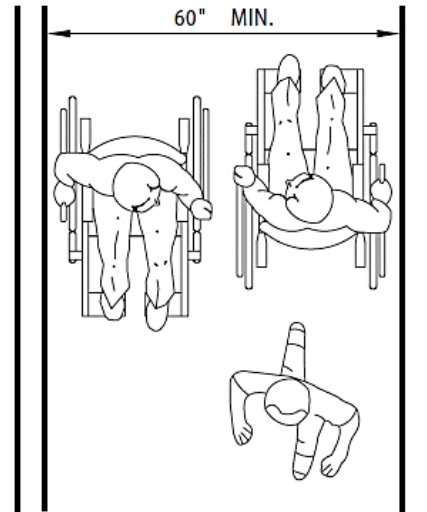


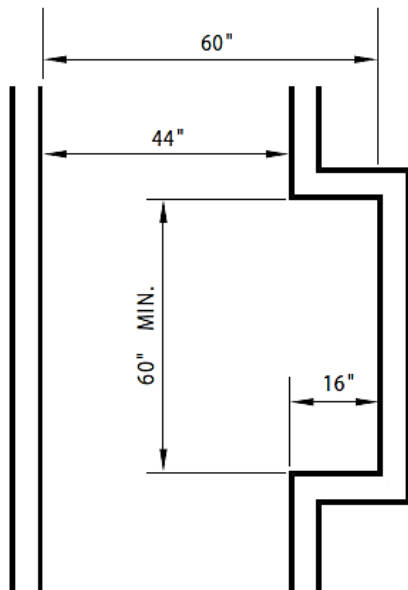
FIGURE 11A-1K



(a) MINIMUM WIDTH FOR CORRIDORS



(b) MINIMUM WIDTH FOR CORRIDORS OVER 200 FEET



(c) PASSING METHODS FOR CORRIDORS WITH LENGTH OVER 200 FEET AND WIDTH LESS THAN 60"

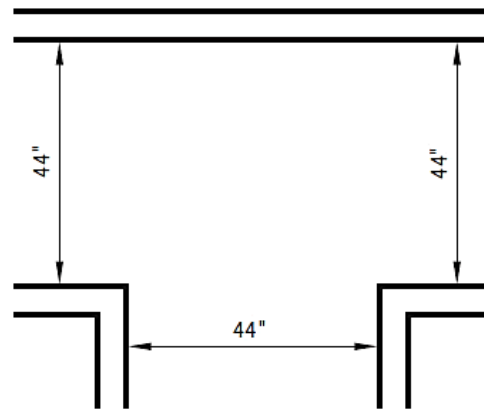
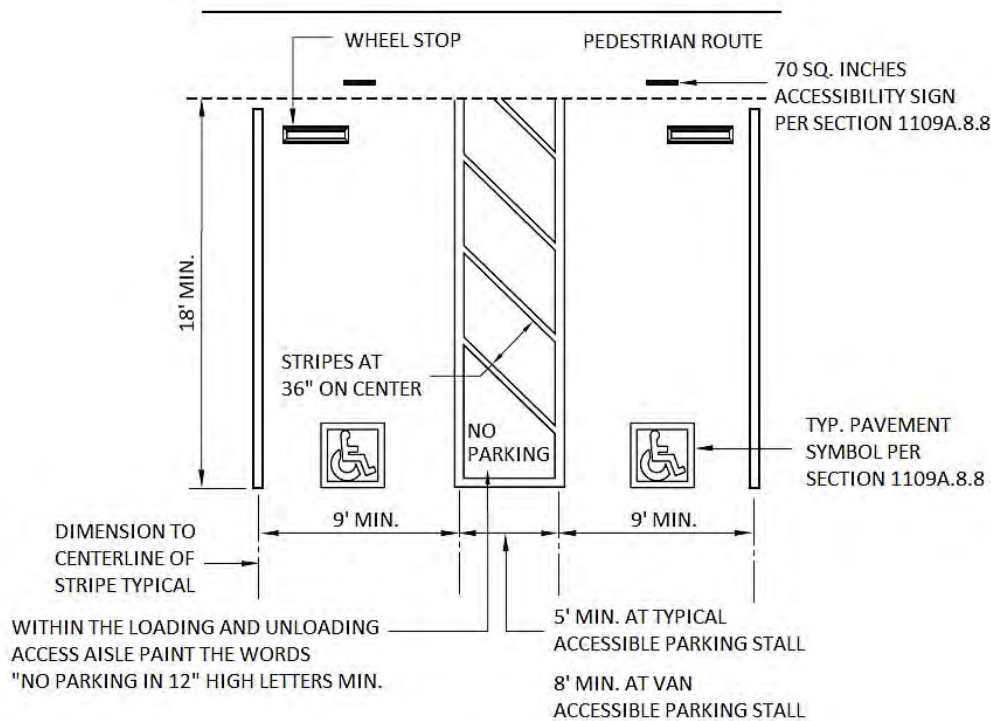
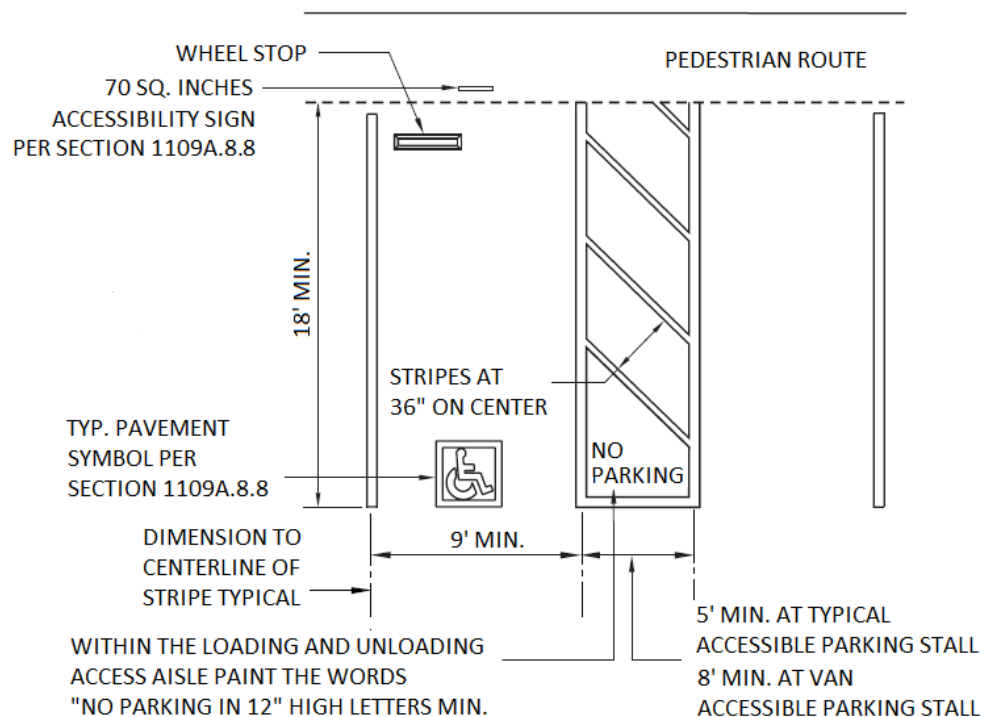


FIGURE 11A-1L  
INTERIOR ACCESSIBLE ROUTE (CORRIDOR) OVER 200 FEET; OCCUPANT LOAD 10 OR MORE

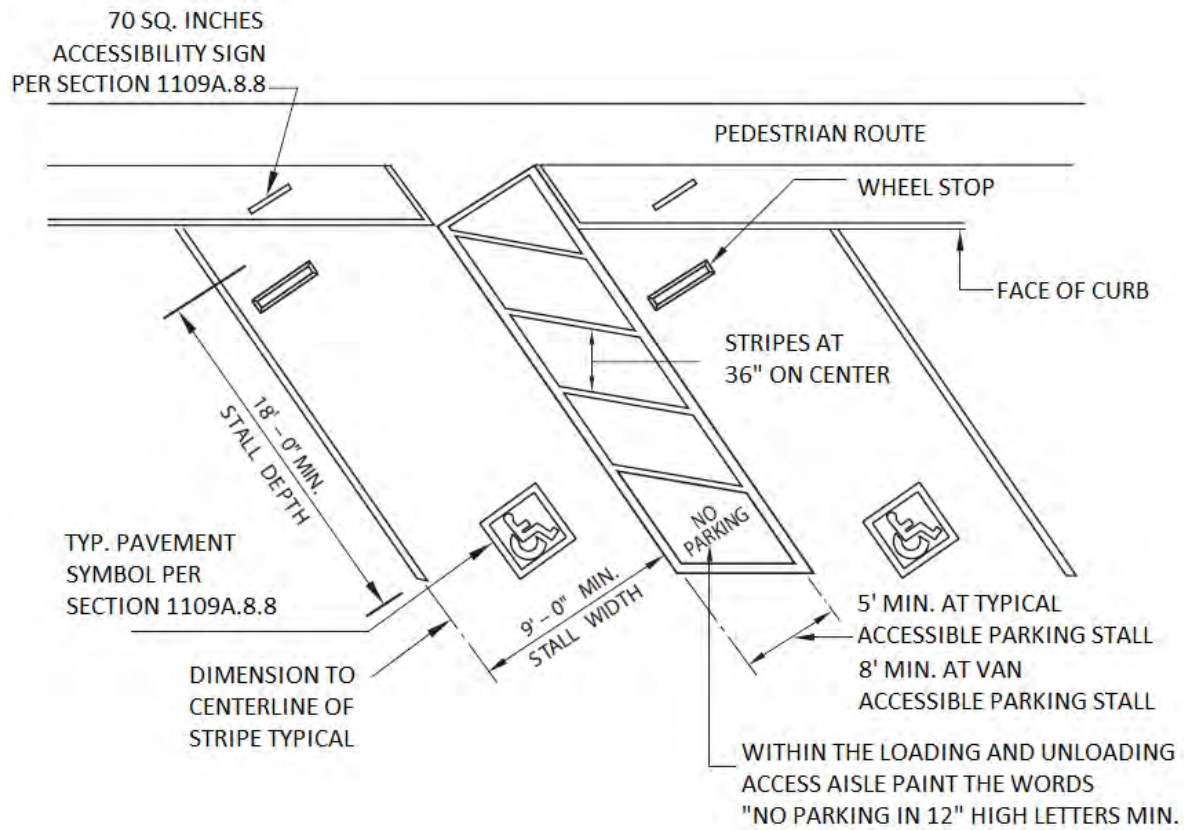




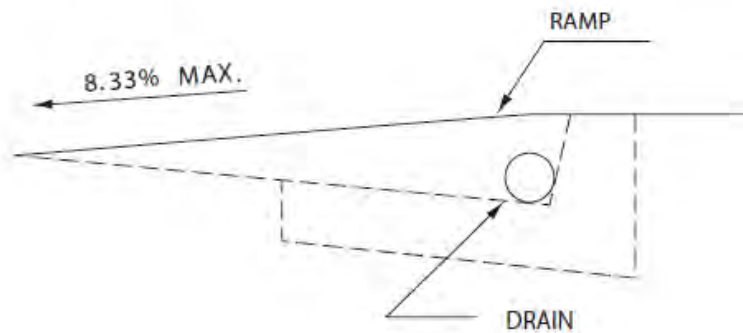
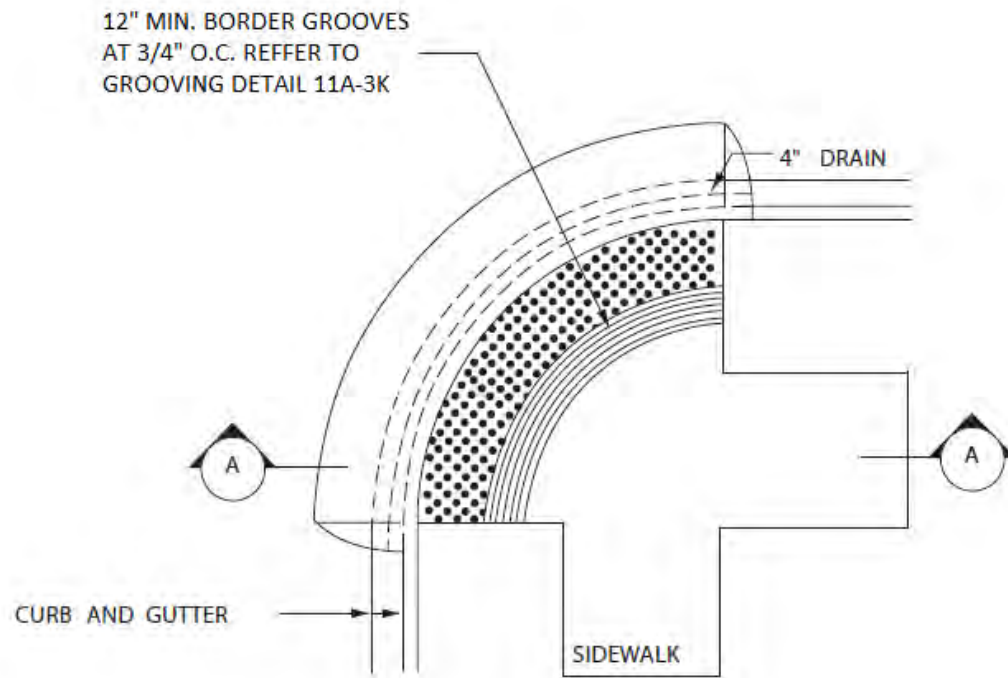
**FIGURE 11A-2A  
DOUBLE PARKING STALLS**



**FIGURE 11A-2B  
SINGLE AND VAN ACCESSIBLE PARKING STALLS**

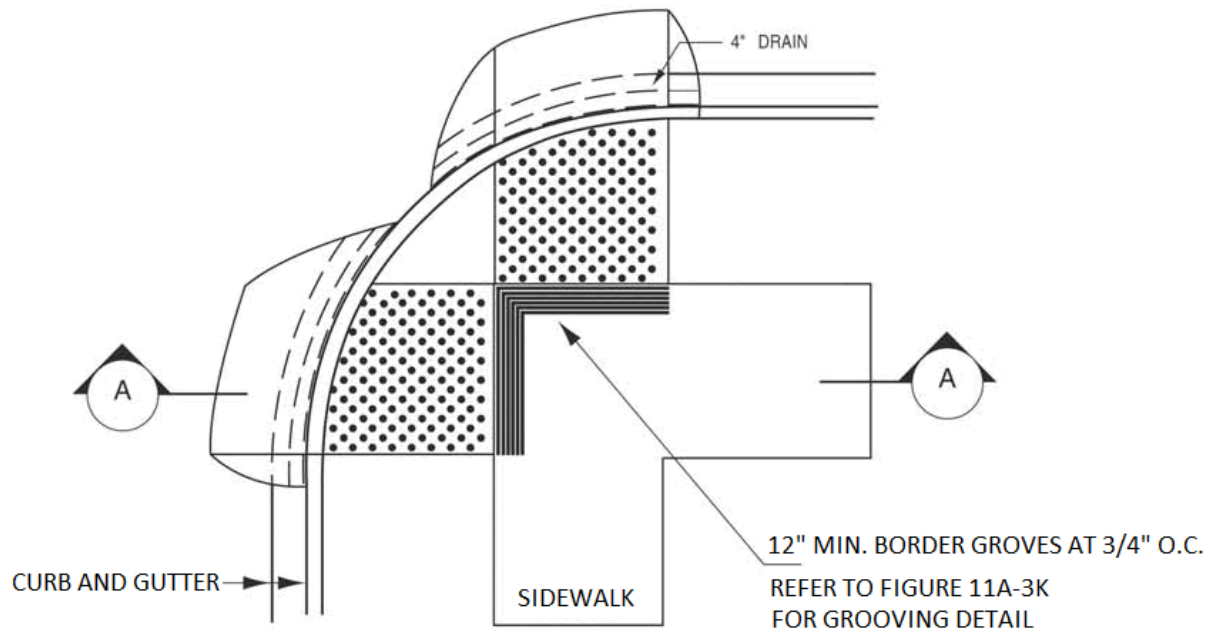


**FIGURE 11A-2C  
DIAGONAL PARKING STALLS**

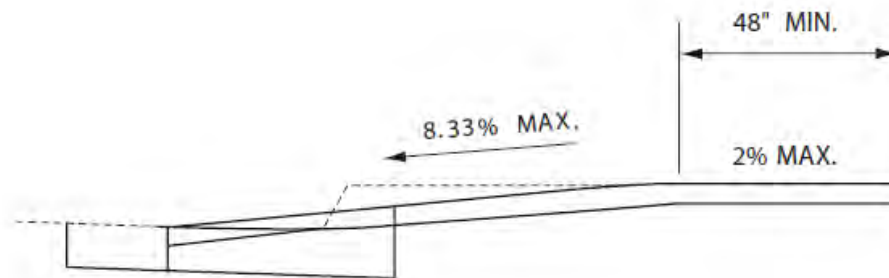
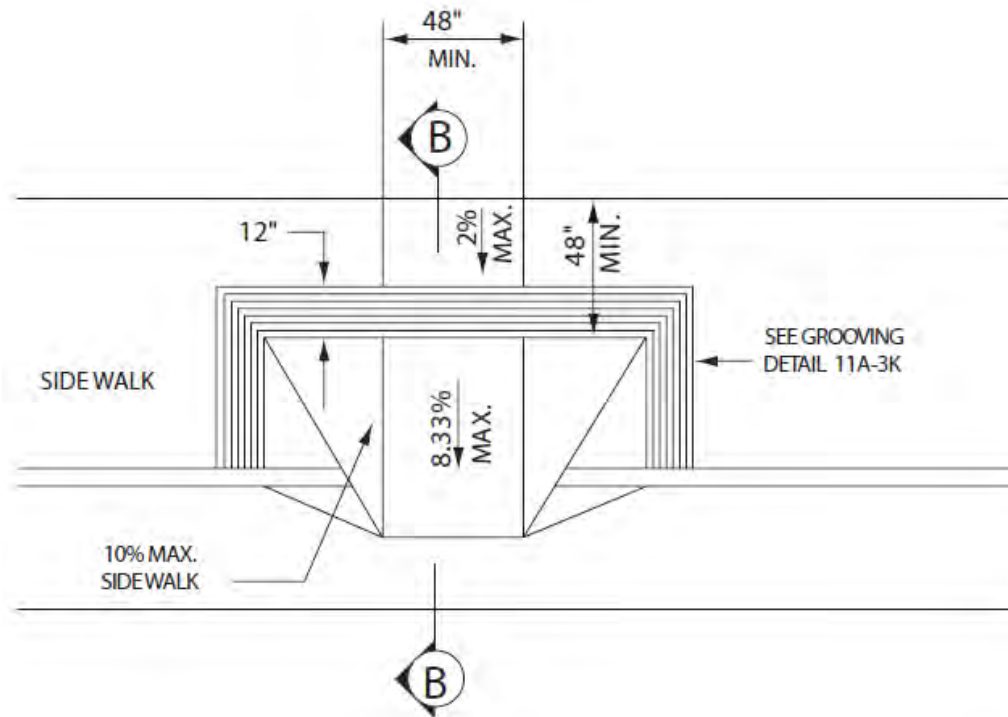


## SECTION A-A

FIGURE 11A-3A  
CURB DETAILS



**FIGURE 11A-3B**  
**CURB DETAIL**



SECTION B-B

FIGURE 11A-3C  
CURB DETAIL

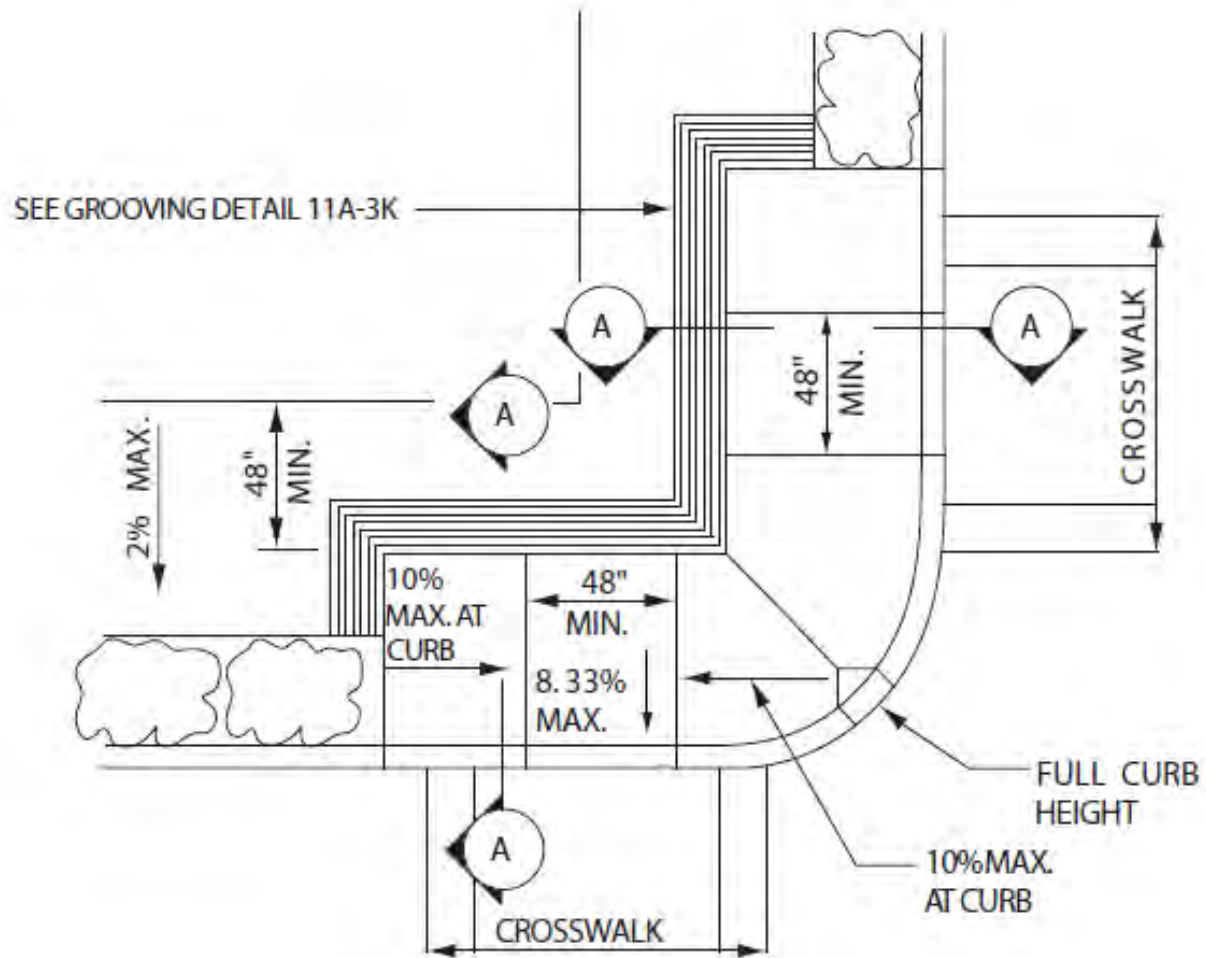


FIGURE 11A-3D  
CURB DETAIL

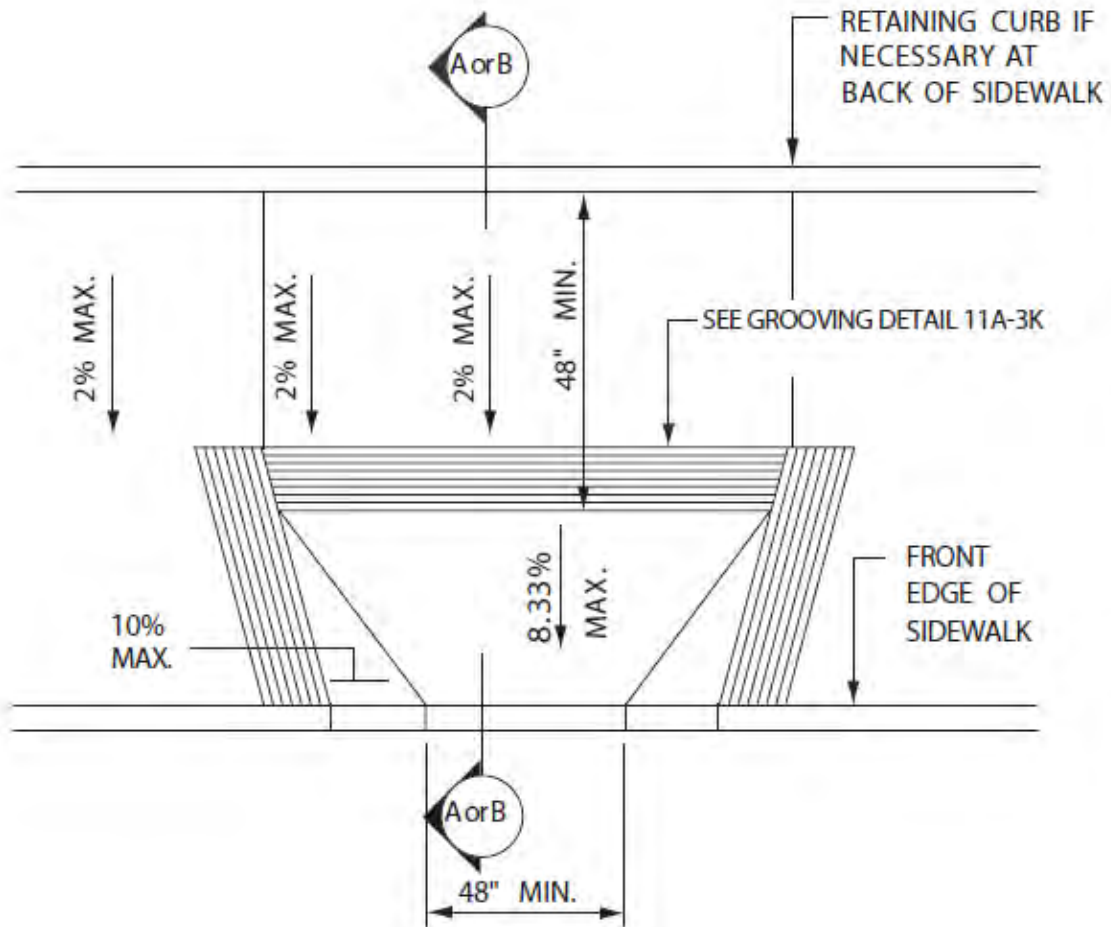


FIGURE 11A-3E  
CURB DETAIL

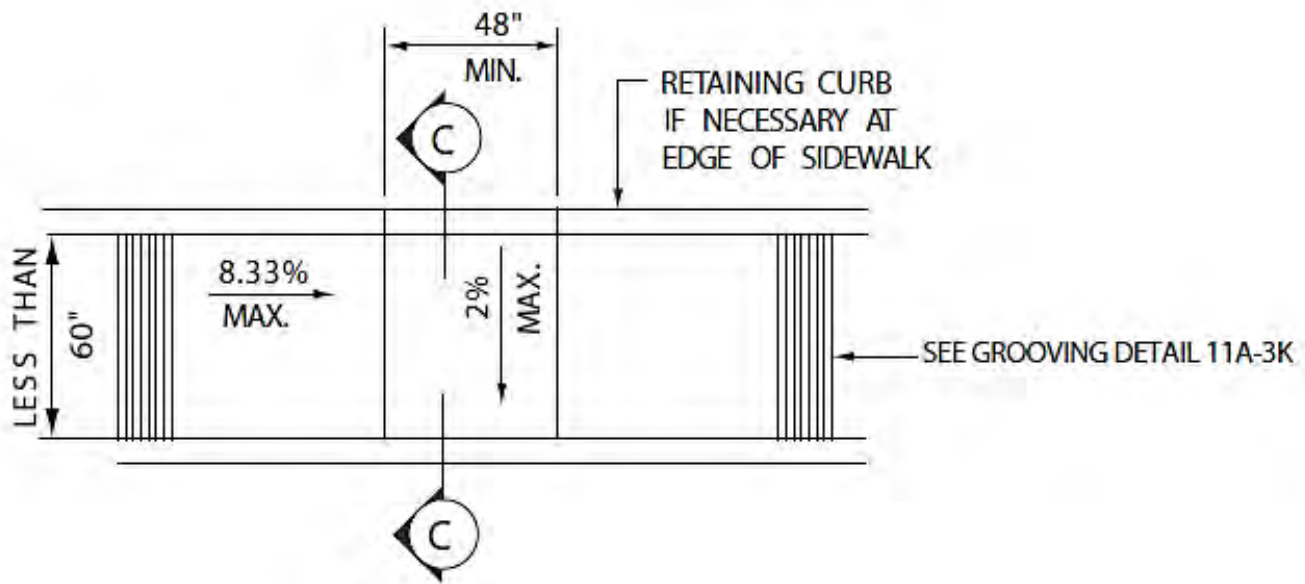


FIGURE 11A-3F  
CURB DETAIL - SIDEWALK LESS THAN 60" WIDE

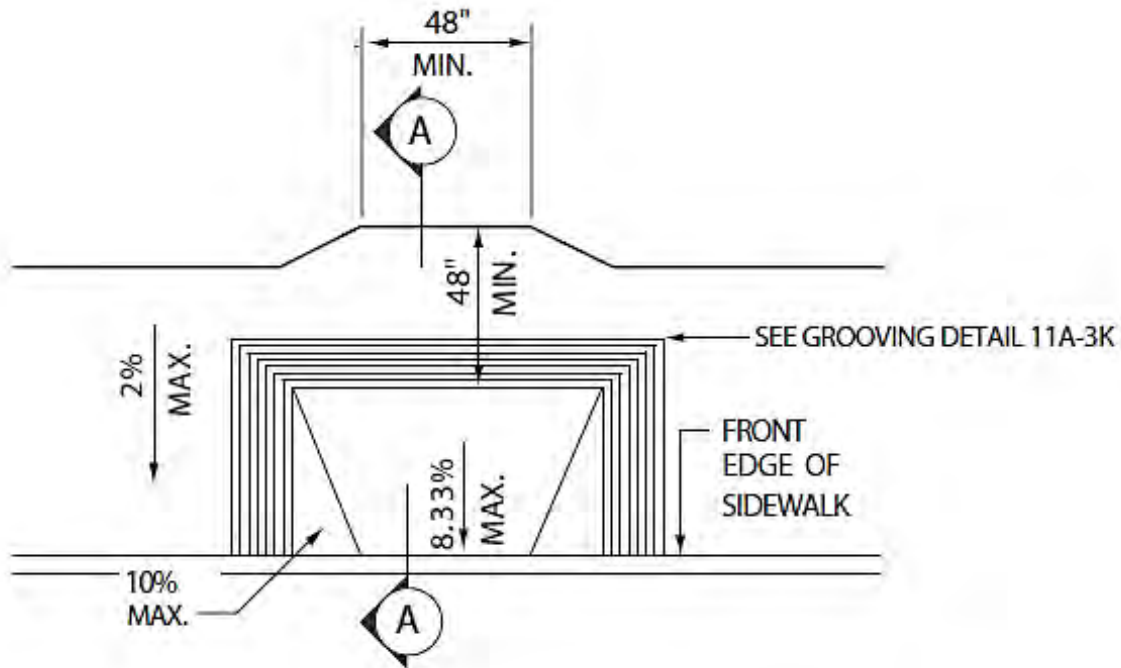
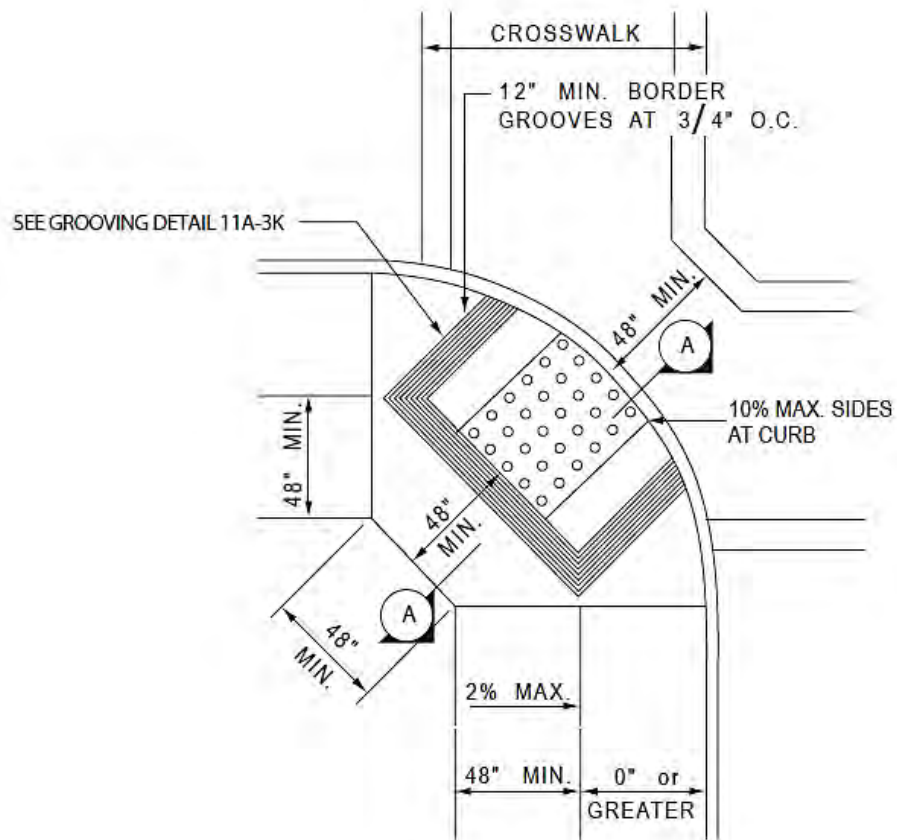
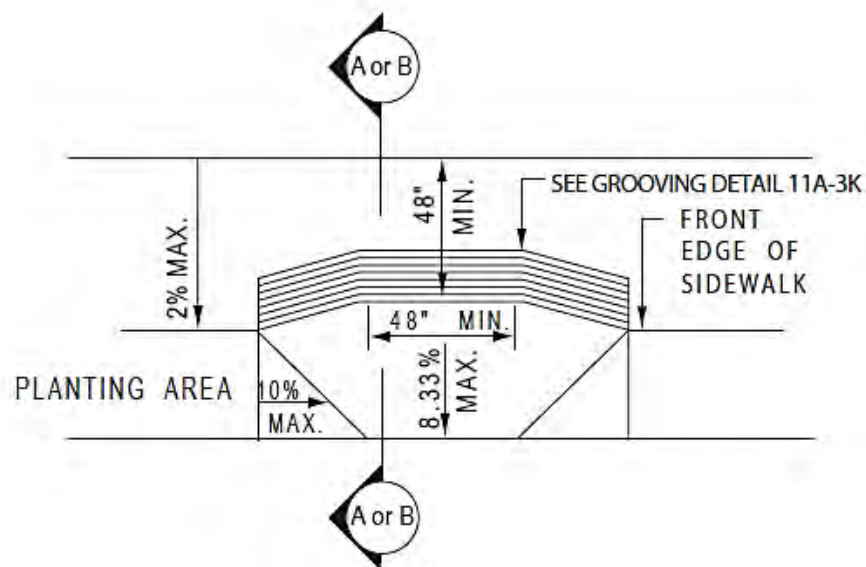


FIGURE 11A-3G  
CURB DETAIL





**FIGURE 11A-3H**  
**CURB DETAIL**



**FIGURE 11A-3I**  
**CURB DETAIL**

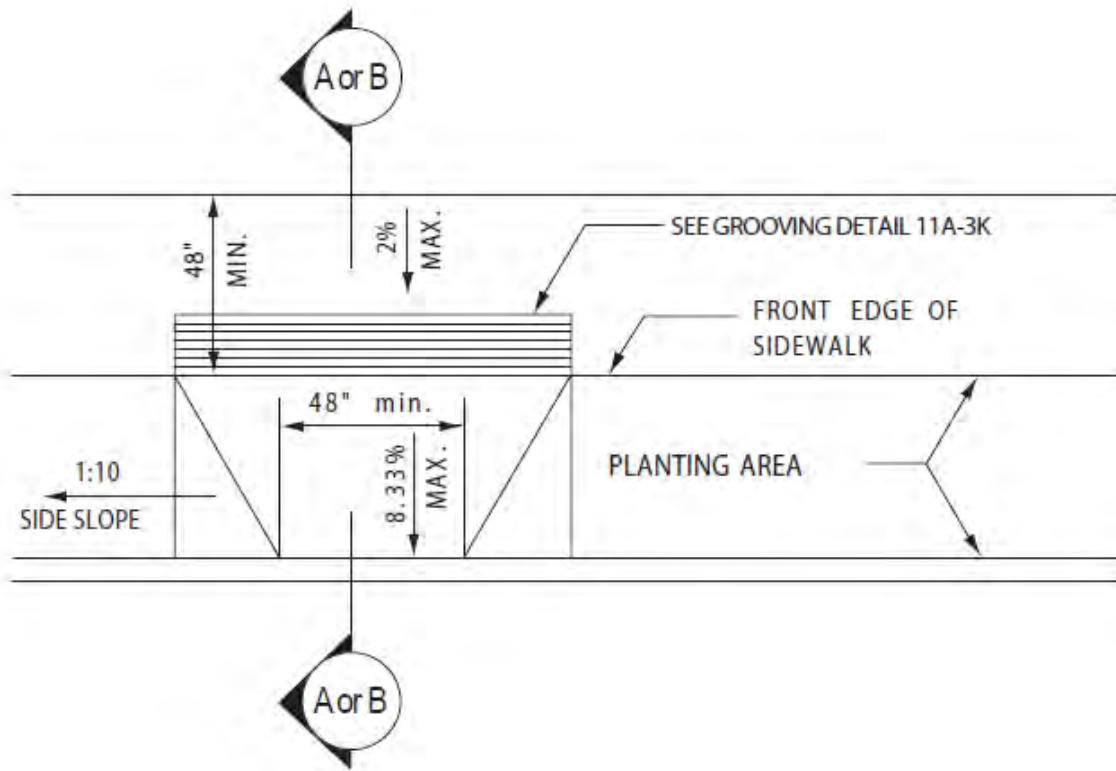
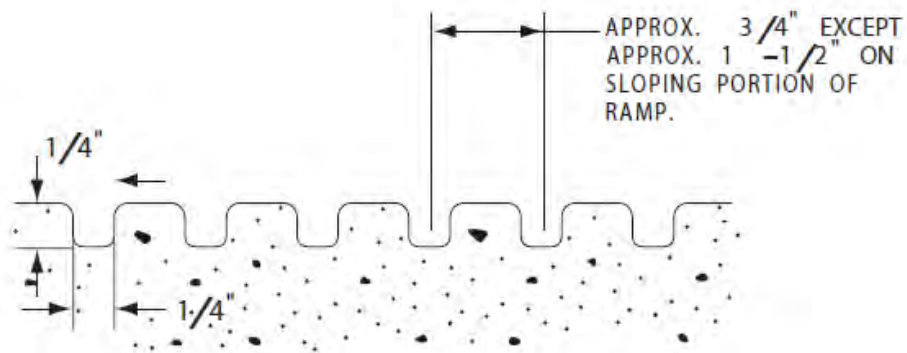
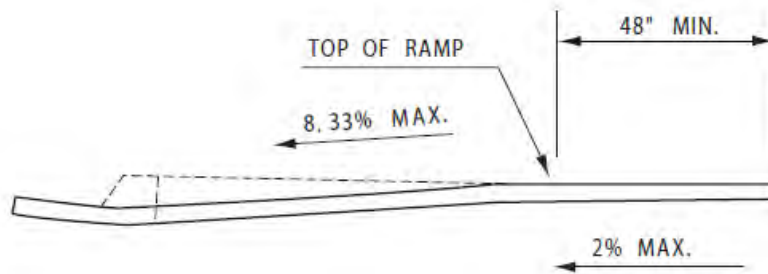
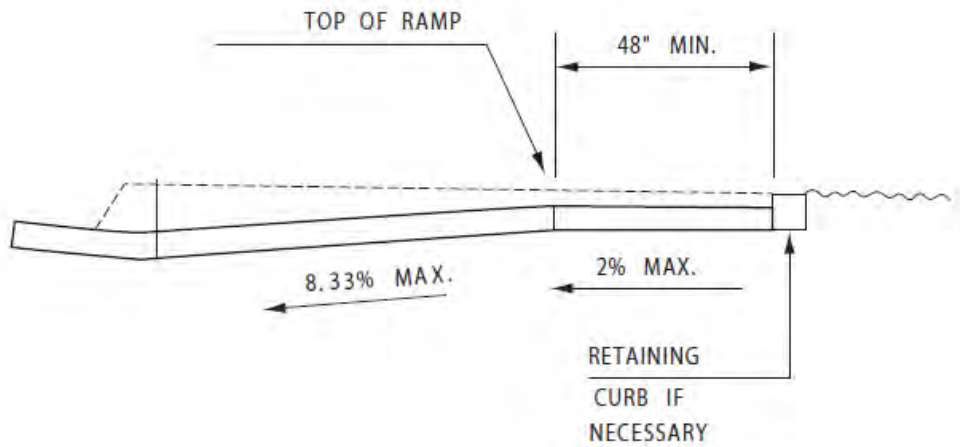


FIGURE 11A-3J  
CURB DETAIL

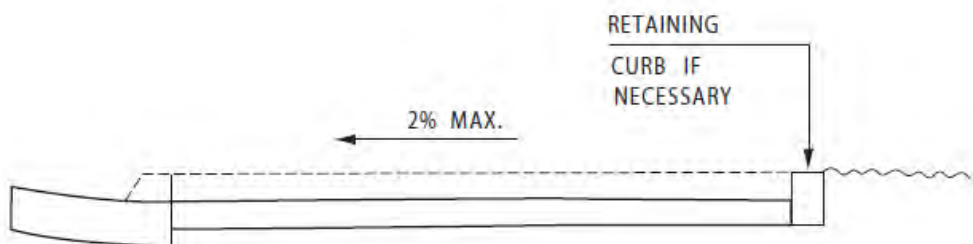


GROOVING DETAIL

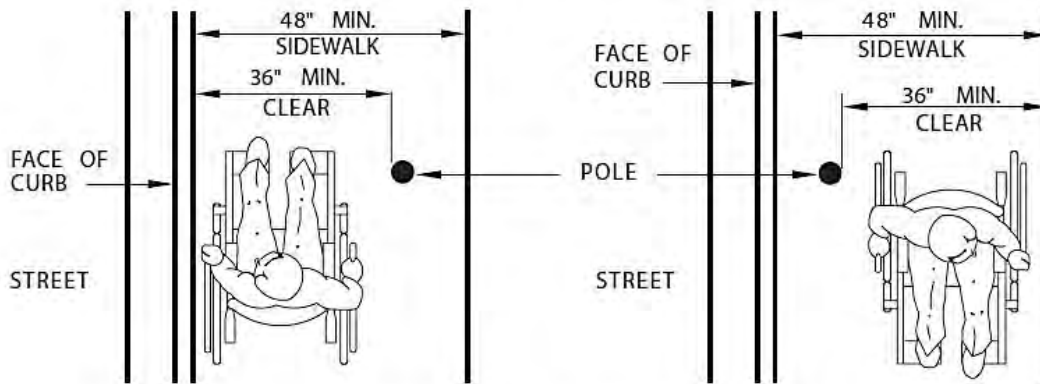
FIGURE 11A-3K  
CURB DETAIL

**SECTION A-A**

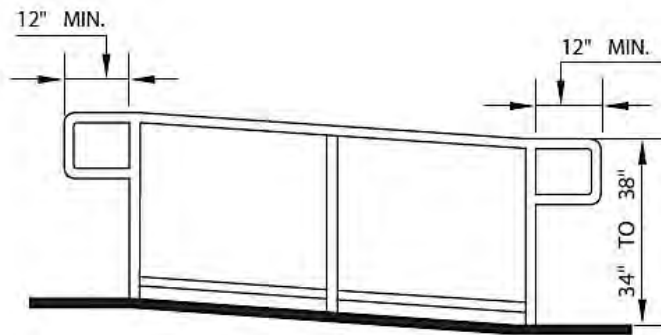
**SECTION B-B**  
**DEPRESS ENTIRE SIDEWALK AS REQUIRED**

**SECTION C-C**

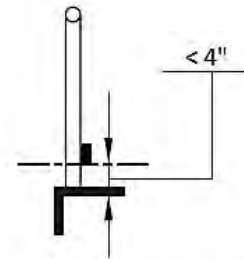
**FIGURE 11A-3L**  
**CURB SECTIONS**



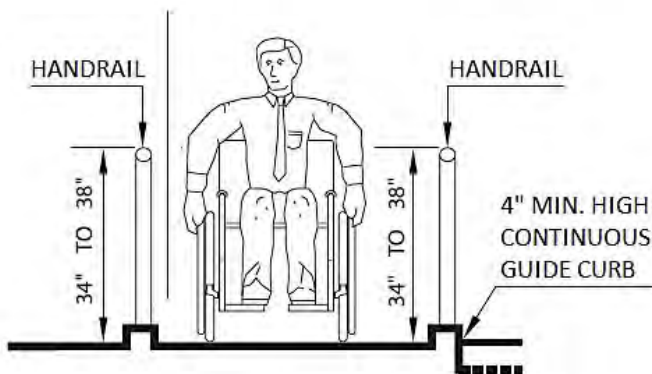
(a) SIDEWALK OBSTRUCTIONS



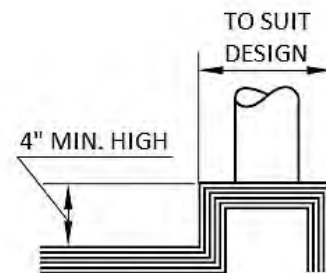
(b) HANDRAIL AND GUIDERAIL



GUIDE RAIL DETAIL



(c) GUIDE CURB



GUIDE CURB DETAIL

FIGURE 11A-5A  
RAMPS AND SIDEWALKS

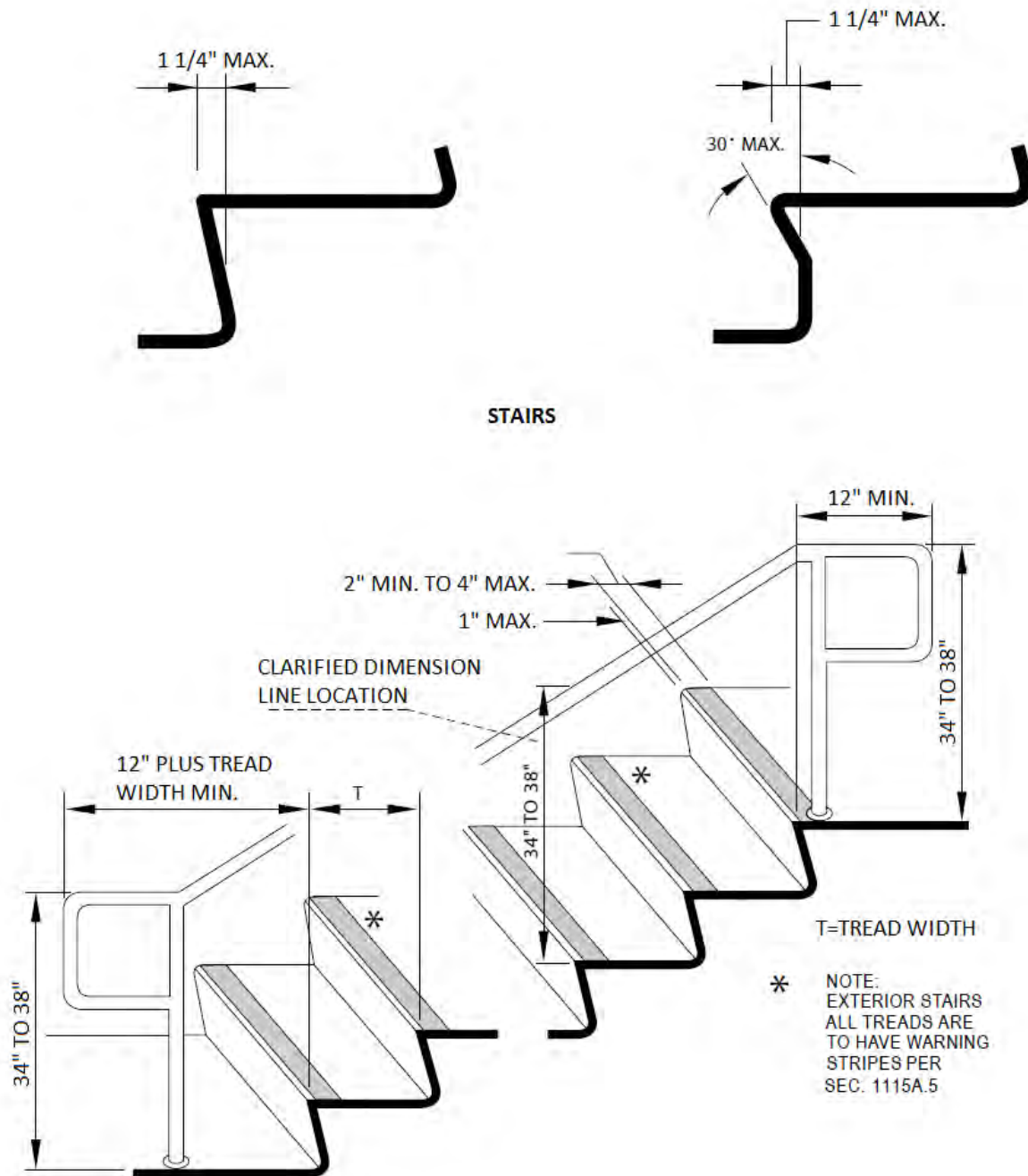


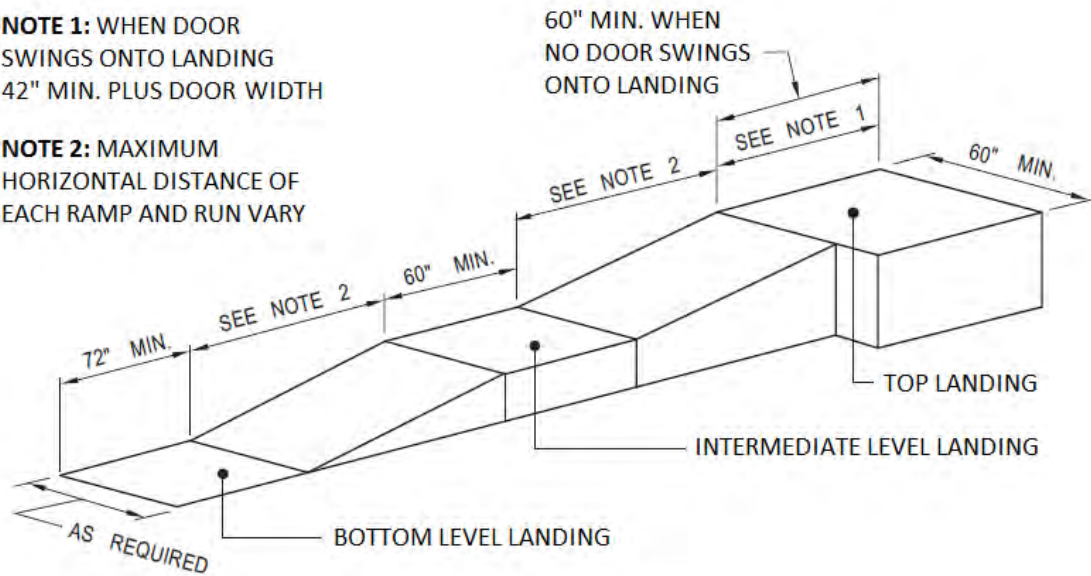
FIGURE 11A-6A  
WARNING STRIPING AND HANDRAIL EXTENSIONS



2013 CALIFORNIA BUILDING CODE

**NOTE 1:** WHEN DOOR  
SWINGS ONTO LANDING  
42" MIN. PLUS DOOR WIDTH

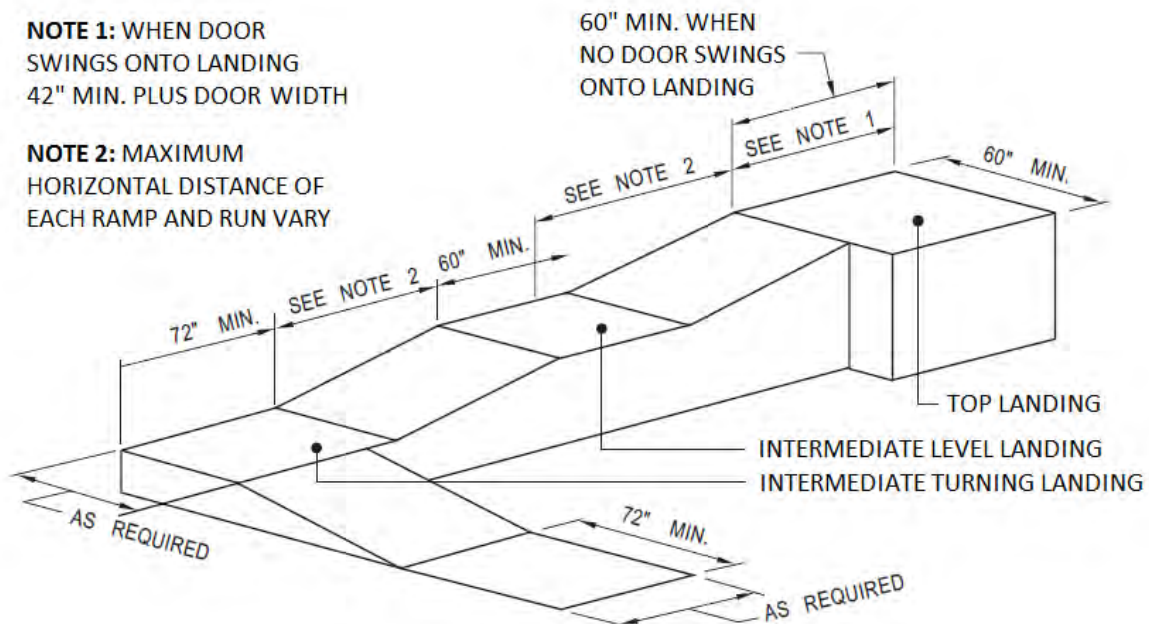
**NOTE 2:** MAXIMUM  
HORIZONTAL DISTANCE OF  
EACH RAMP AND RUN VARY



**(a) STRAIGHT RAMP RUN**

**NOTE 1:** WHEN DOOR  
SWINGS ONTO LANDING  
42" MIN. PLUS DOOR WIDTH

**NOTE 2:** MAXIMUM  
HORIZONTAL DISTANCE OF  
EACH RAMP AND RUN VARY



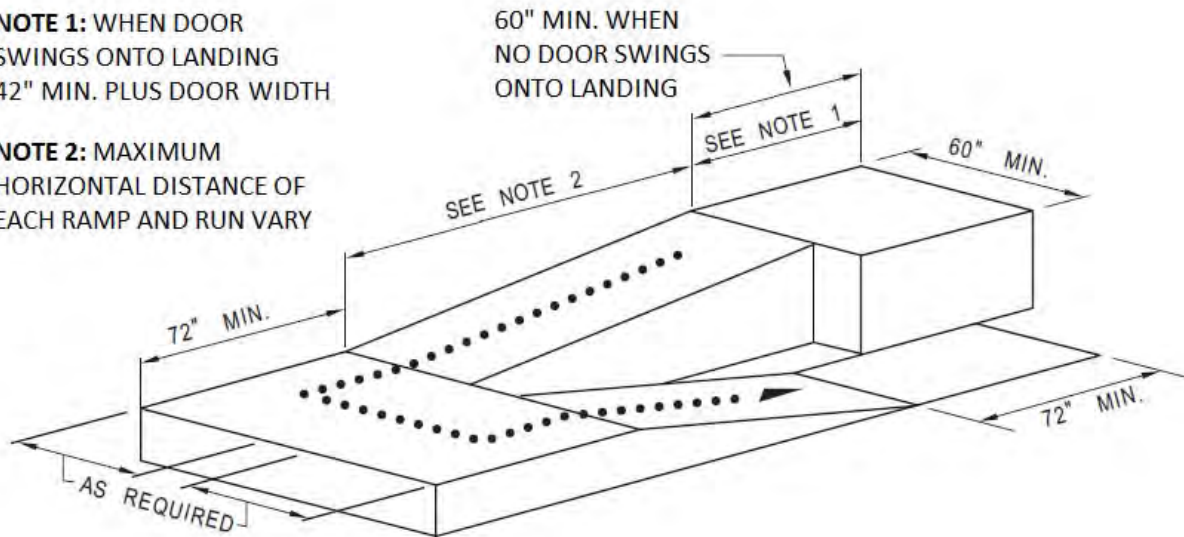
**(b) RAMP WITH TURNING LANDING**

**FIGURE 11A-6C  
RAMP DIMENSIONS**



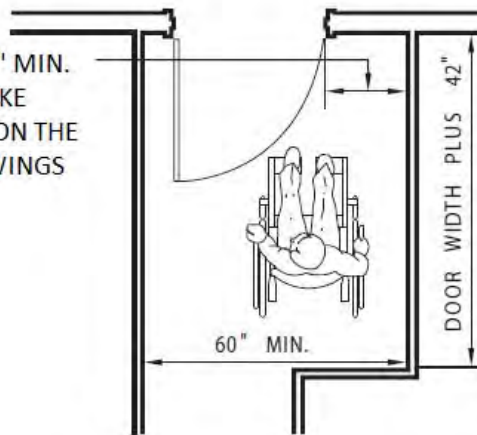
**NOTE 1:** WHEN DOOR SWINGS ONTO LANDING  
42" MIN. PLUS DOOR WIDTH

**NOTE 2:** MAXIMUM  
HORIZONTAL DISTANCE OF  
EACH RAMP AND RUN VARY



**(a) RAMP WITH INTERMEDIATE SWITCH BACK LANDING**

24" MIN. EXTERIOR AND 18" MIN.  
INTERIOR BEYOND THE STRIKE  
EDGE OF A GATE OR DOOR ON THE  
SIDE TOWARD WHICH IT SWINGS



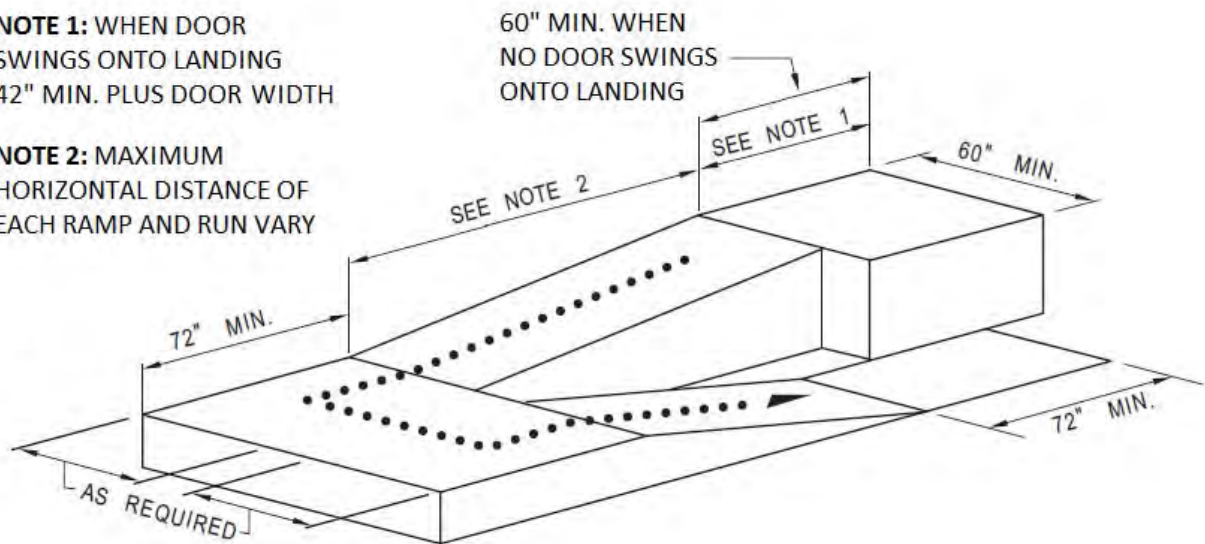
**(b) RAMP LANDING AT DOORWAY**

**FIGURE 11A-6D  
RAMP LANDING AND DOORWAY**



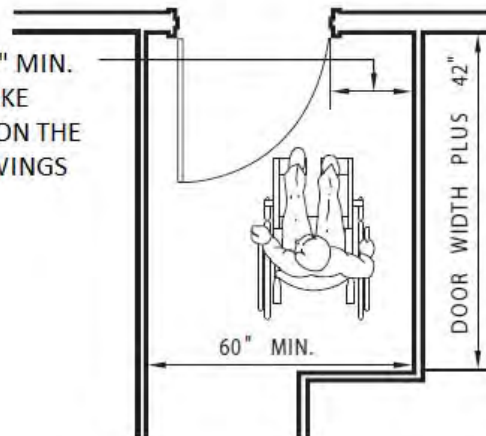
**NOTE 1:** WHEN DOOR SWINGS ONTO LANDING  
42" MIN. PLUS DOOR WIDTH

**NOTE 2:** MAXIMUM  
HORIZONTAL DISTANCE OF  
EACH RAMP AND RUN VARY



**(a) RAMP WITH INTERMEDIATE SWITCH BACK LANDING**

24" MIN. EXTERIOR AND 18" MIN.  
INTERIOR BEYOND THE STRIKE  
EDGE OF A GATE OR DOOR ON THE  
SIDE TOWARD WHICH IT SWINGS



**(b) RAMP LANDING AT DOORWAY**

**FIGURE 11A-6D  
RAMP LANDING AND DOORWAY**

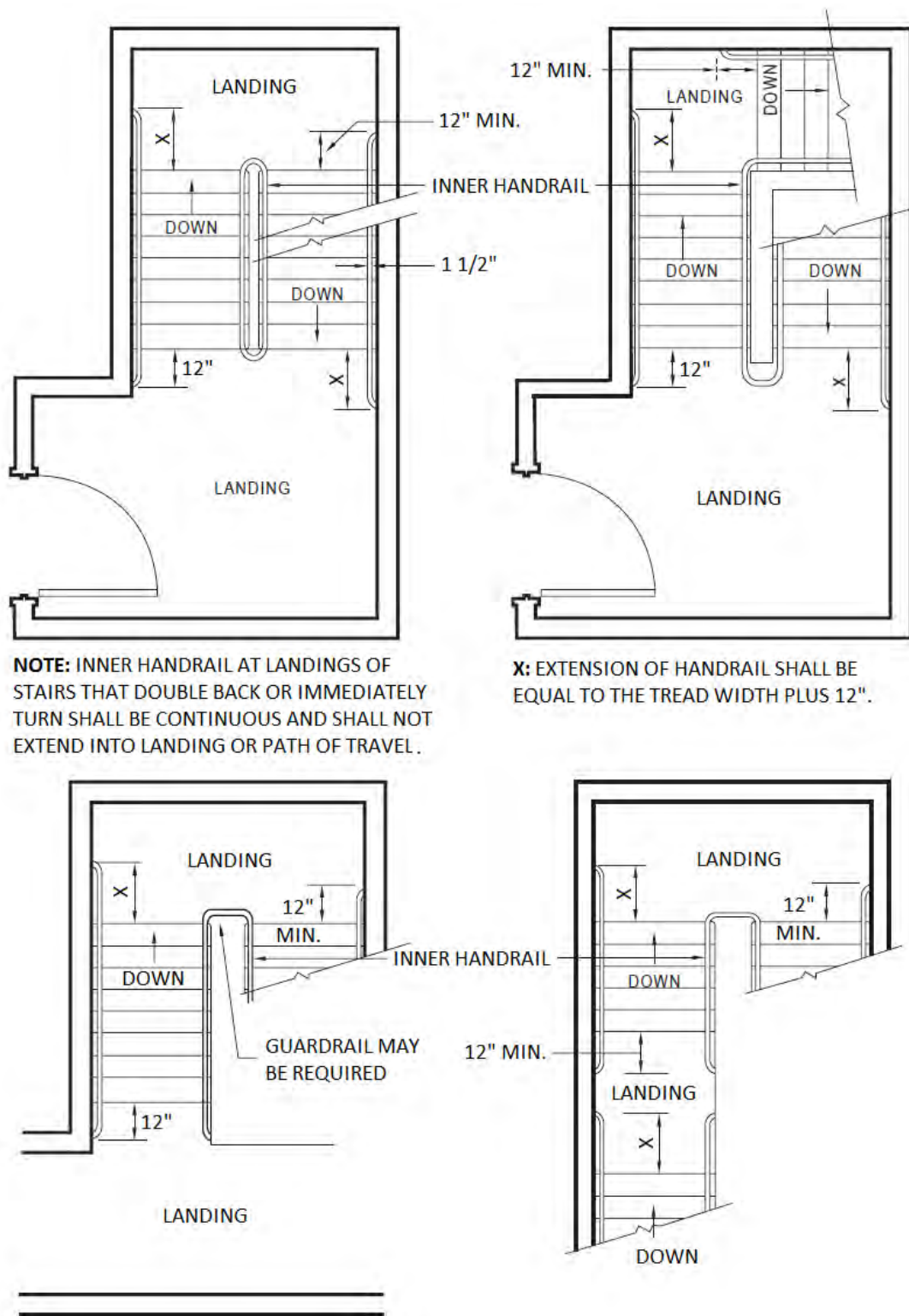
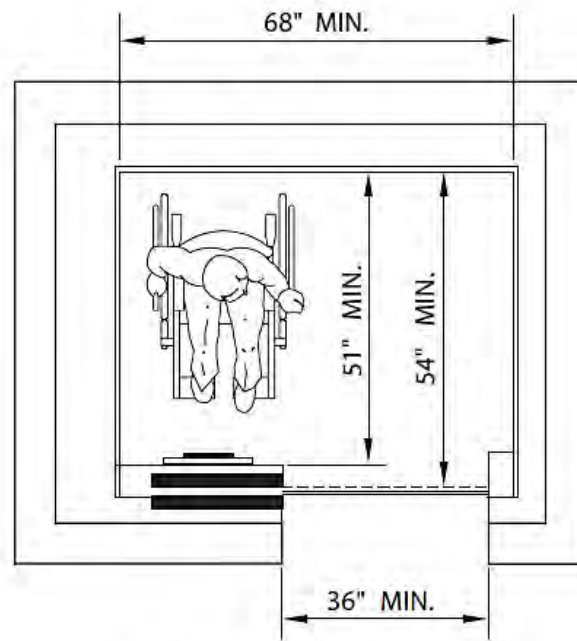
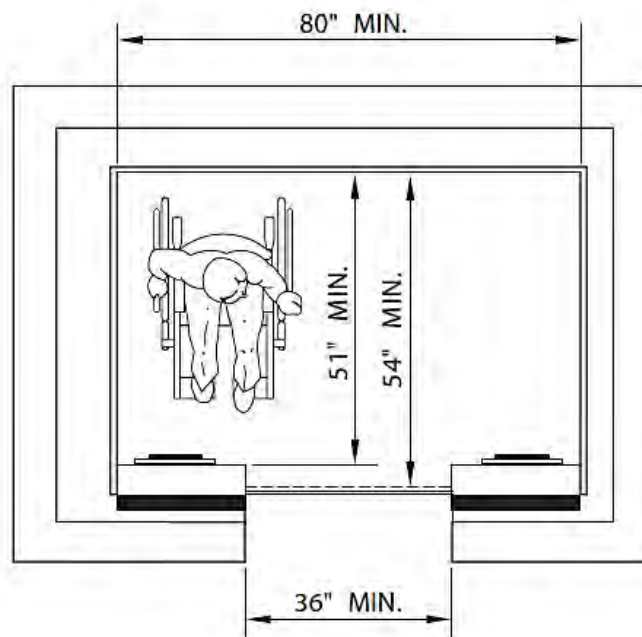


FIGURE 11A-6E  
STAIR HANDRAILS



(a) SIDE OPENING DOOR



(b) CENTER OPENING DOOR

FIGURE 11A-7A  
MINIMUM DIMENSIONS OF ELEVATOR CARS

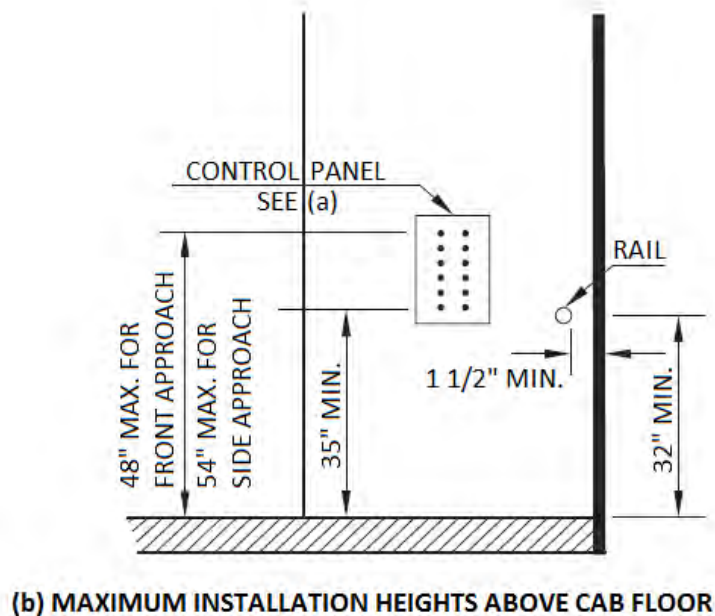
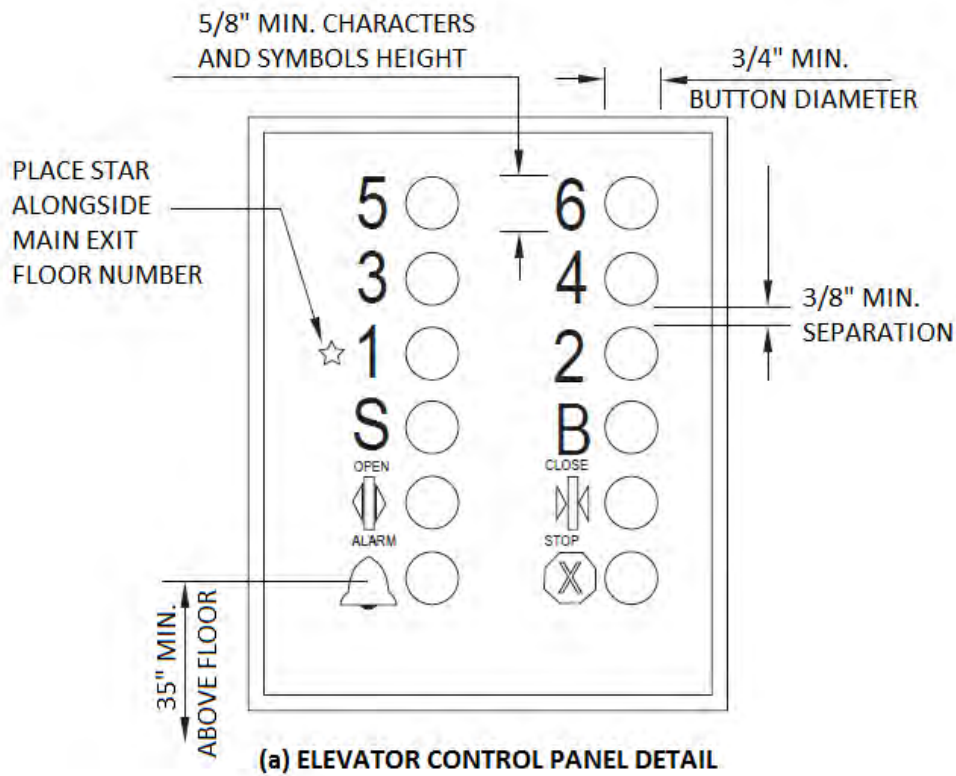
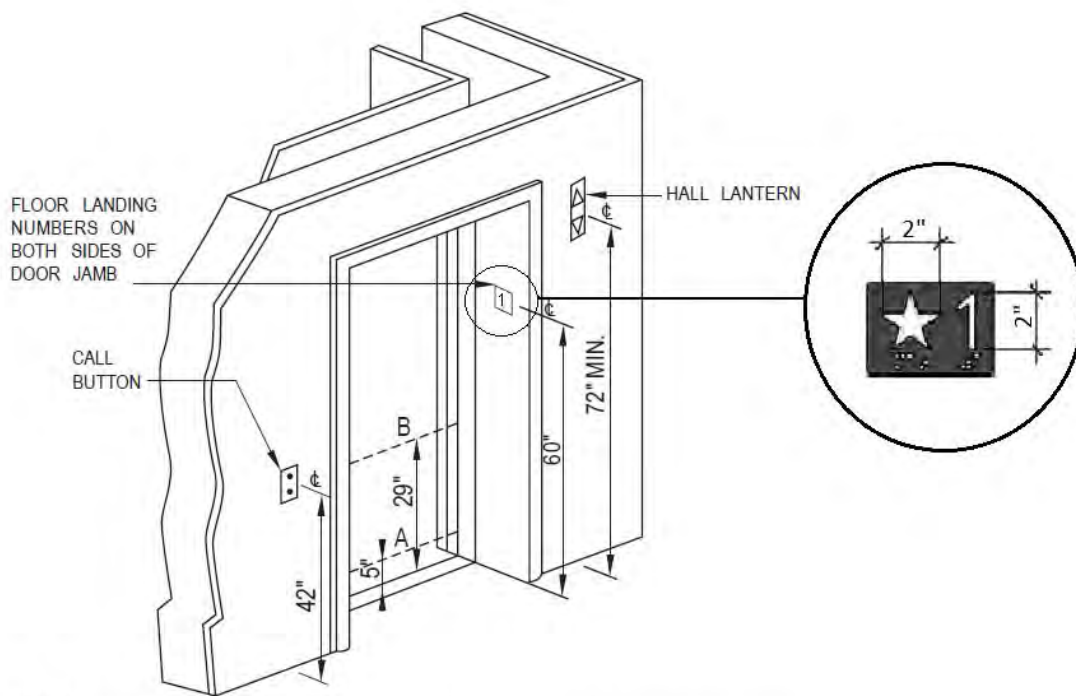
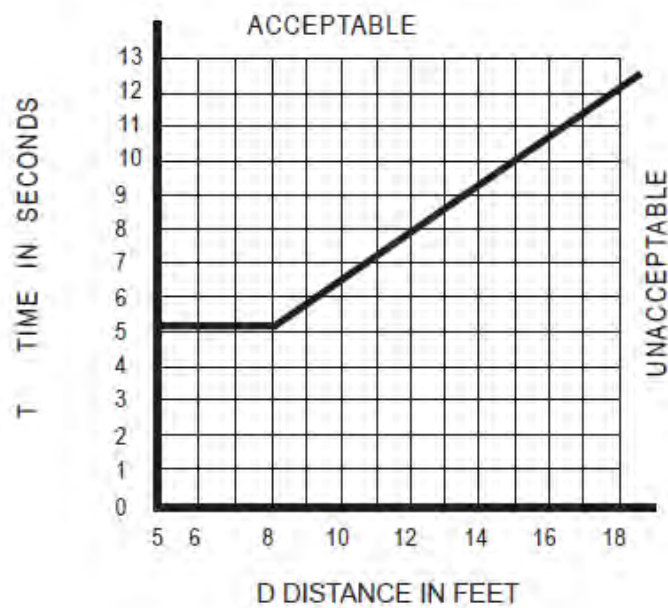


FIGURE 11A-7B  
ELEVATOR CONTROL PANEL

**NOTE:**

THE AUTOMATIC DOOR REOPENING DEVICE IS ACTIVATED IF AN OBJECT PASSES THROUGH EITHER LINE A OR LINE B. LINE A AND LINE B REPRESENT THE VERTICAL LOCATION OF THE DOOR REOPENING DEVICE NOT REQUIRING CONTACT.

**FIGURE 11A-7C  
HOISTWAY AND ELEVATOR ENTRANCES**



**FIGURE 11A-7D  
GRAPH OF TIMING EQUATION**

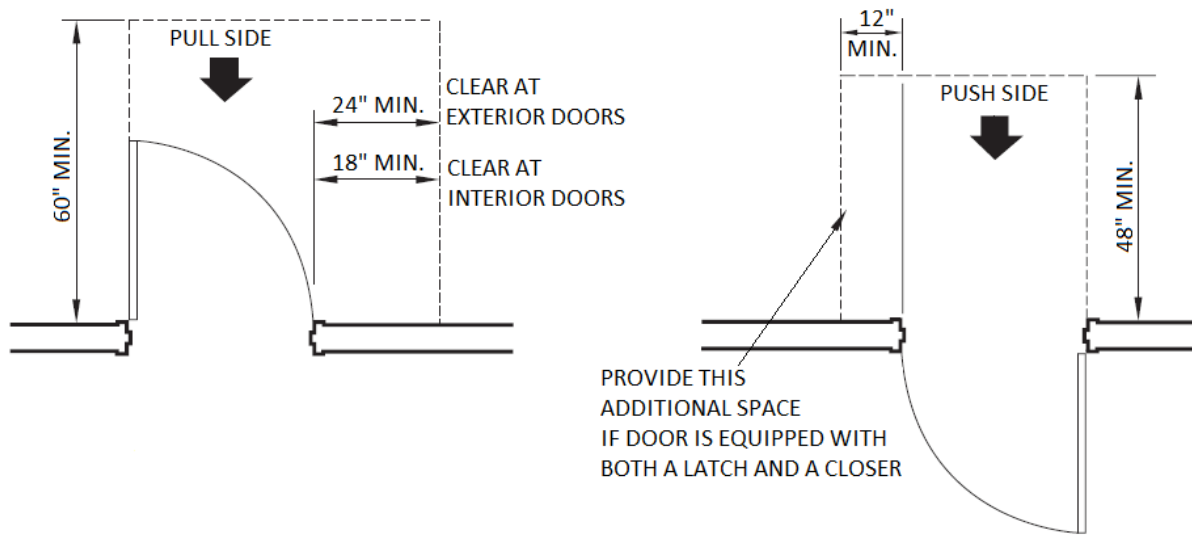


FIGURE 11A-8A  
FRONT APPROACHES—SWINGING DOORS

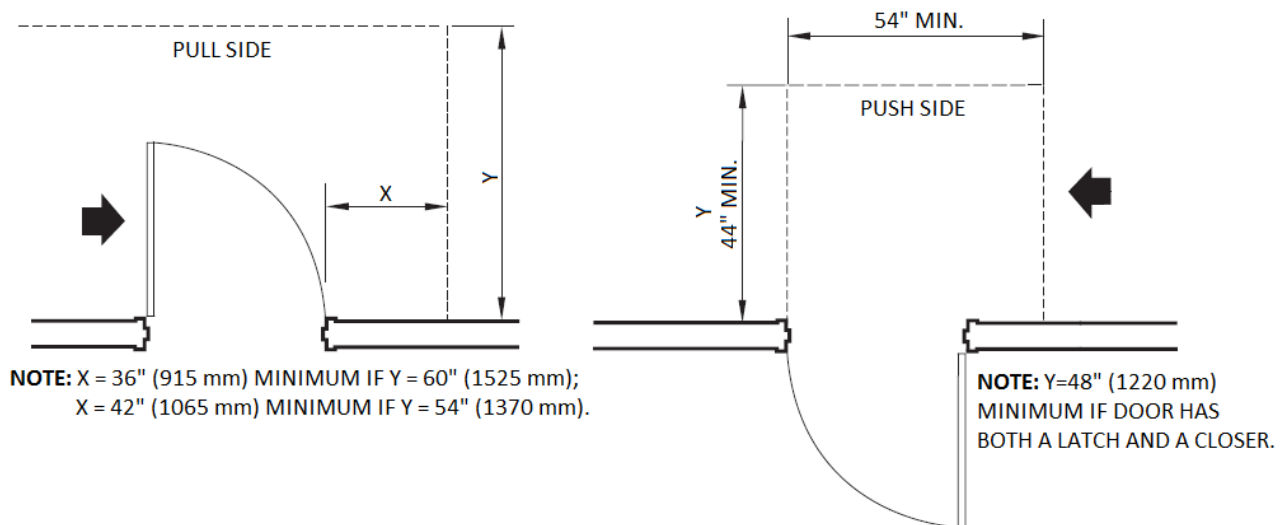
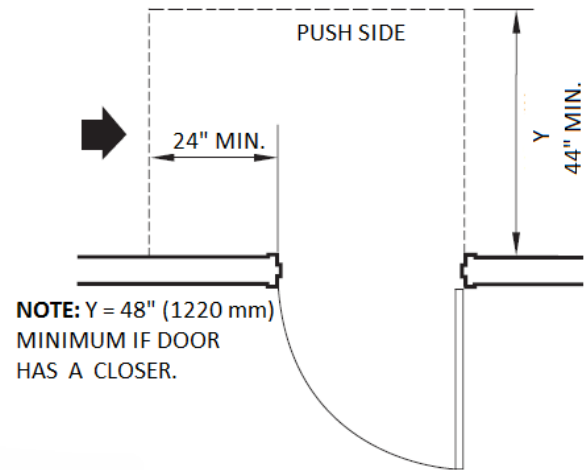
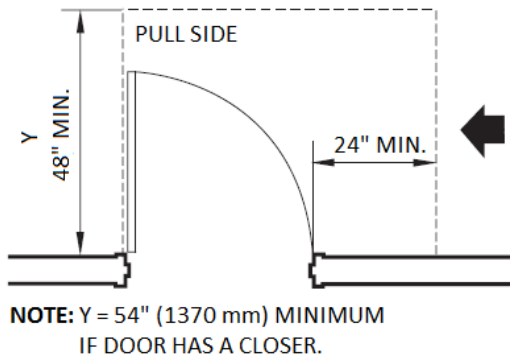
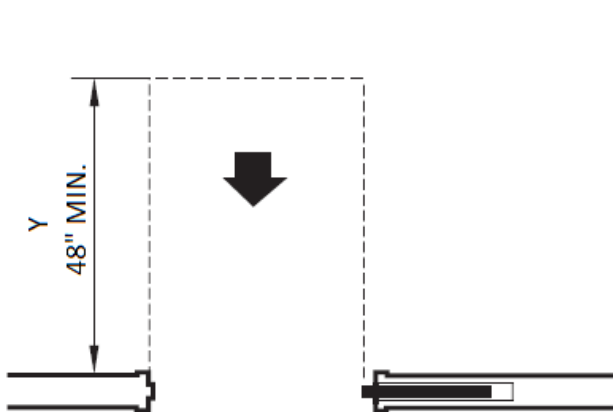


FIGURE 11A-8B  
HINGE SIDE APPROACHES—SWINGING DOORS

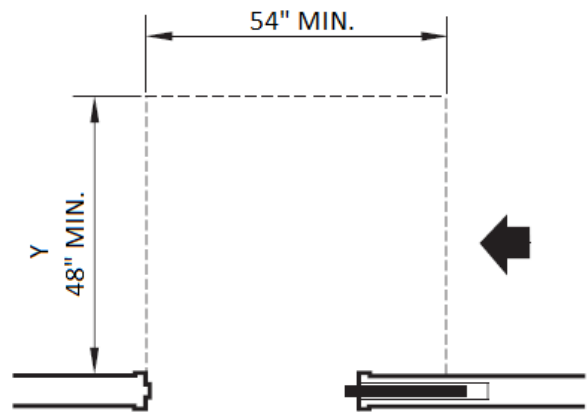
LEVEL MANEUVERING CLEARANCE AT DOORS



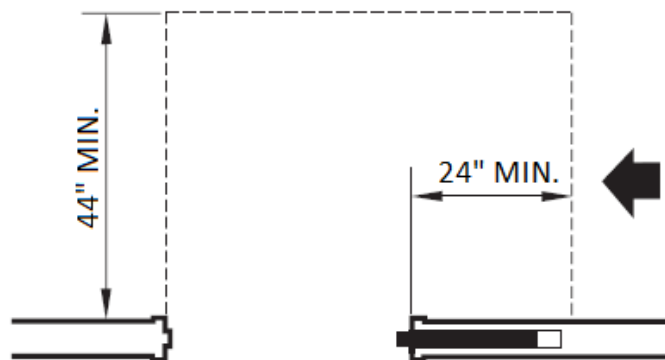
**FIGURE 11A-8C**  
LATCH SIDE APPROACH—SWINGING DOORS



**FIGURE 11A-8D**  
FRONT APPROACH—SLIDING DOORS  
AND FOLDING DOORS

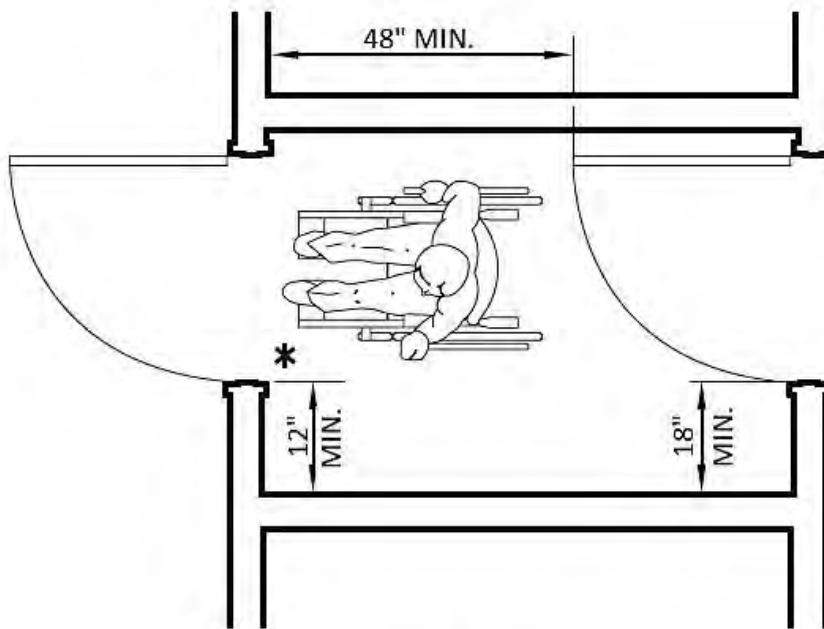


**FIGURE 11A-8E**  
SLIDE SIDE APPROACH—SLIDING DOORS  
AND FOLDING DOORS

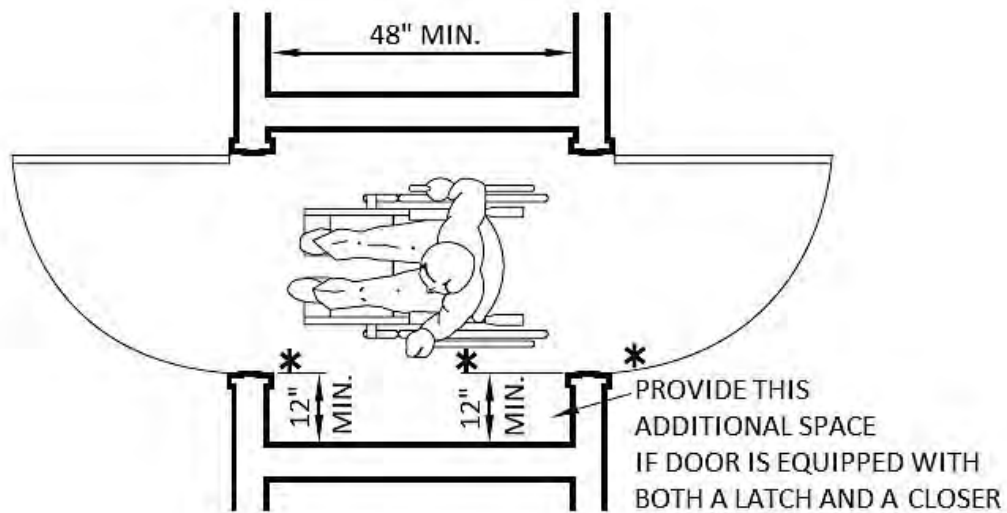


**FIGURE 11A-8F**  
LATCH SIDE APPROACH—SLIDING DOORS AND FOLDING DOORS





(a) DOOR IN SERIES

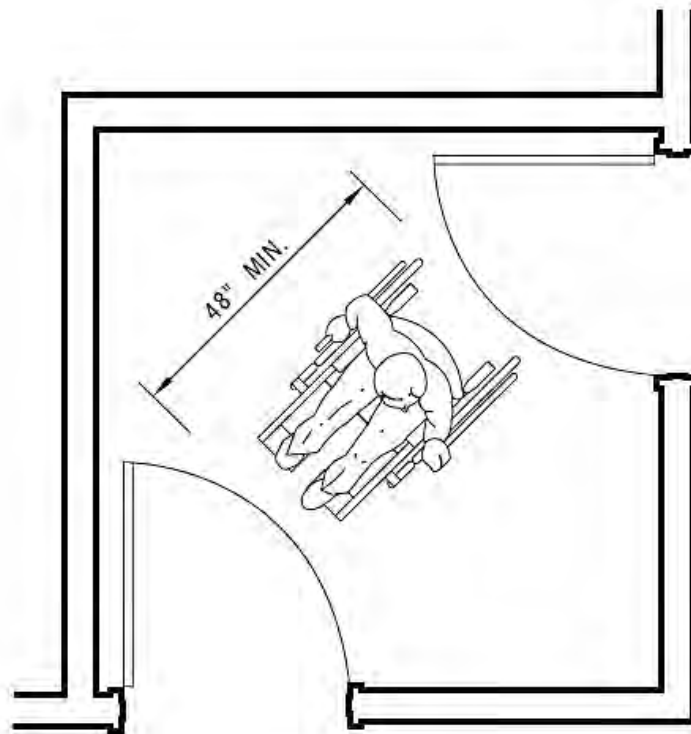


(b) BOTH DOORS OPEN OUT

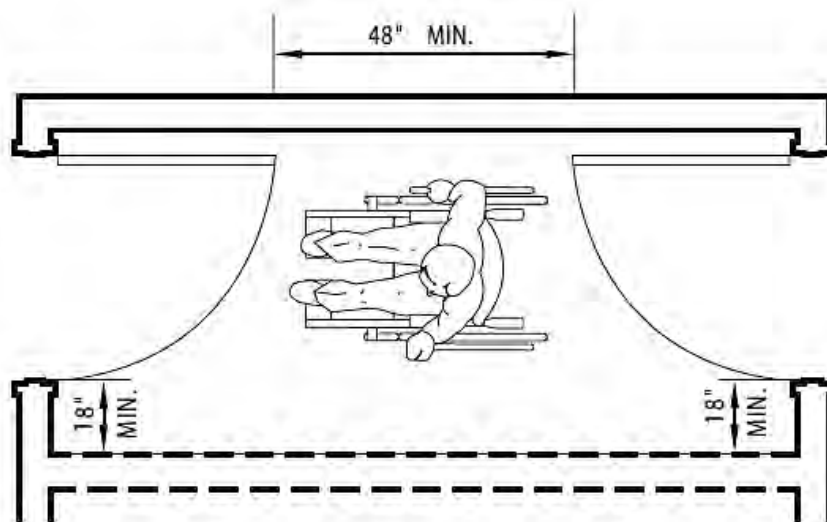
(SERVING OTHER THAN A REQUIRED EXIT STAIRWAY)

FIGURE 11A-8G  
VESTIBULE



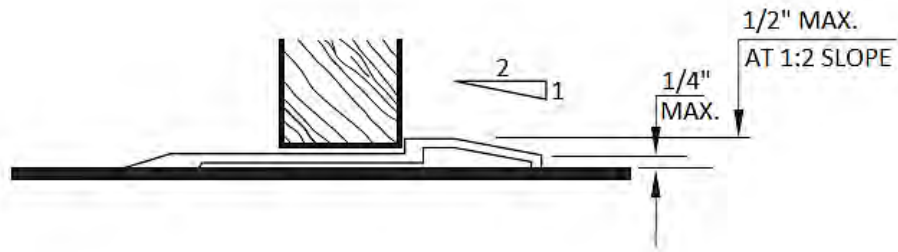


(a) DOORS AT ADJACENT WALLS

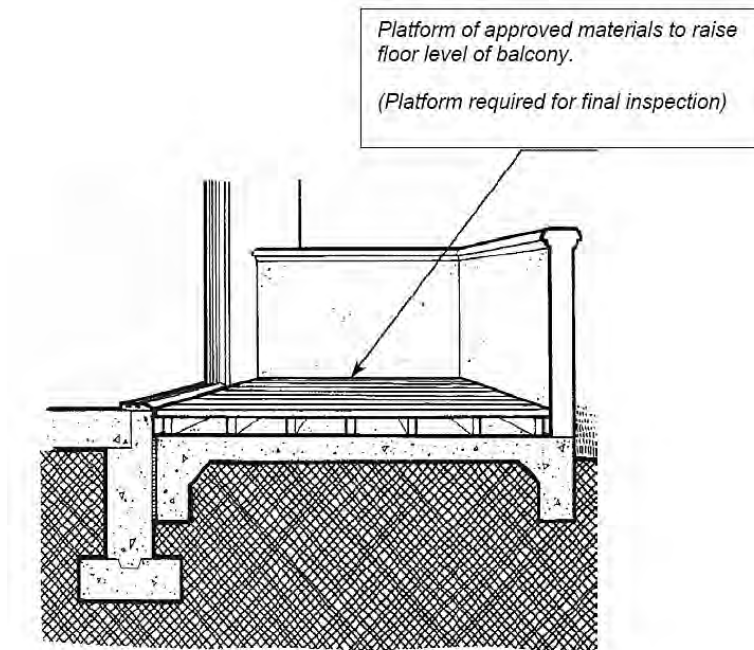


(b) DOORS AT OPPOSITE WALLS

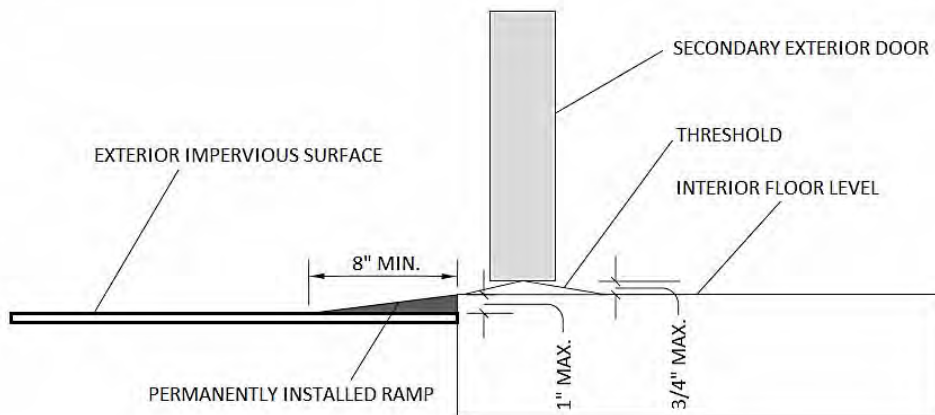
**FIGURE 11A-8H**  
**VESTIBULE**  
**(SERVING OTHER THAN A REQUIRED EXIT STAIRWAY)**



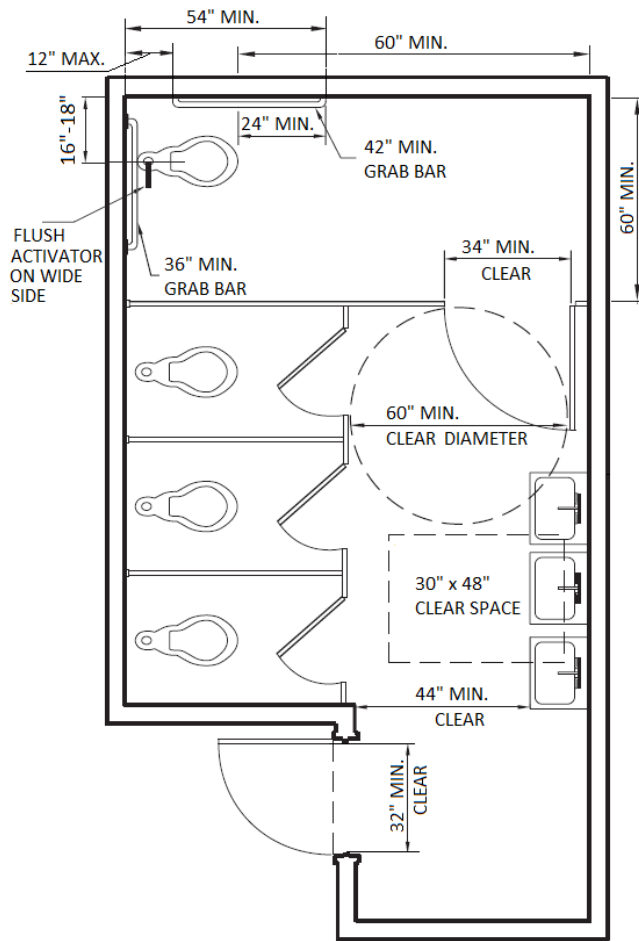
**FIGURE 11A-8I  
THRESHOLDS**



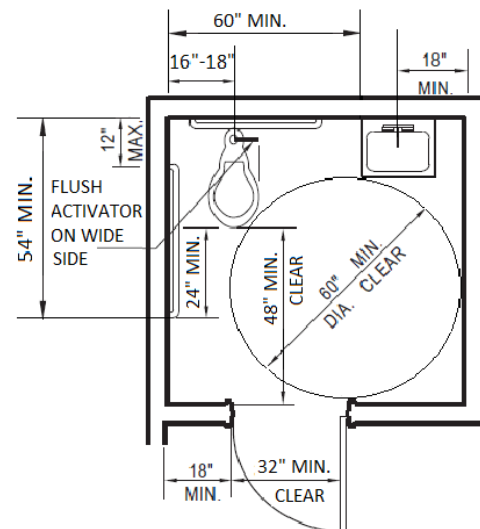
**FIGURE 11A-8J  
PLATFORM AT SECONDARY EXTERIOR DOOR**



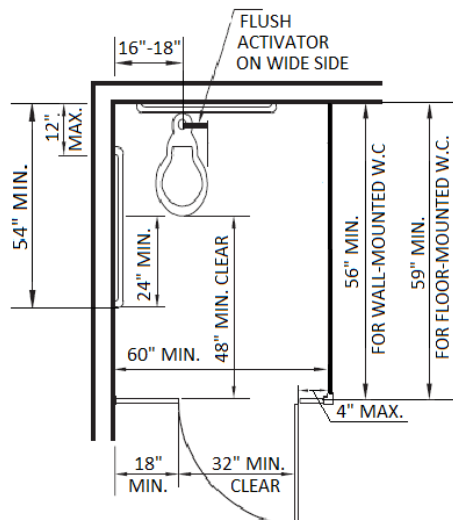
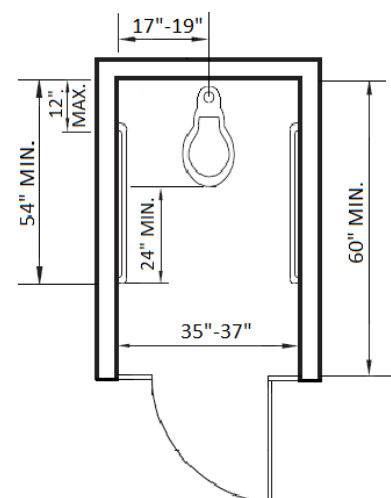
**FIGURE 11A-8K  
RAMP AT SECONDARY EXTERIOR DOOR**



(a) MULTIPLE-ACCOMMODATION TOILET FACILITY

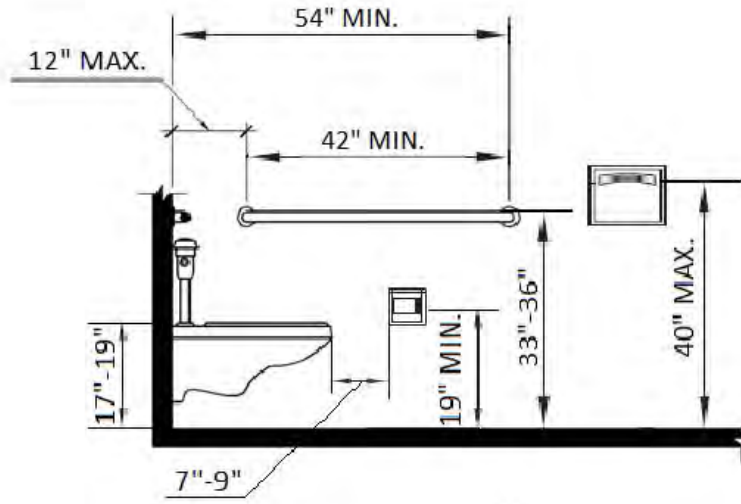


(b) SINGLE-ACCOMMODATION TOILET FACILITY

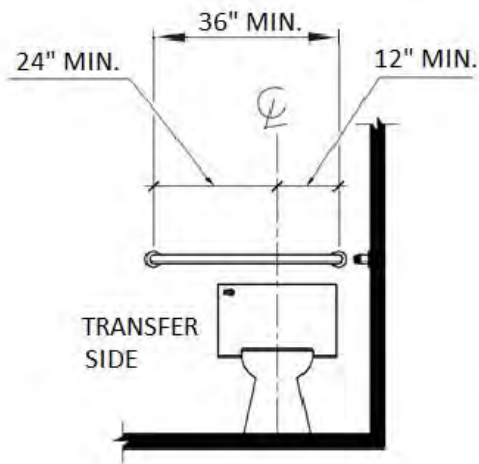
(c) ACCESSIBLE WATER CLOSET COMPARTMENT  
WITHIN MULTIPLE-ACCOMMODATION TOILET FACILITY

(d) AMBULATORY ACCESSIBLE COMPARTMENT

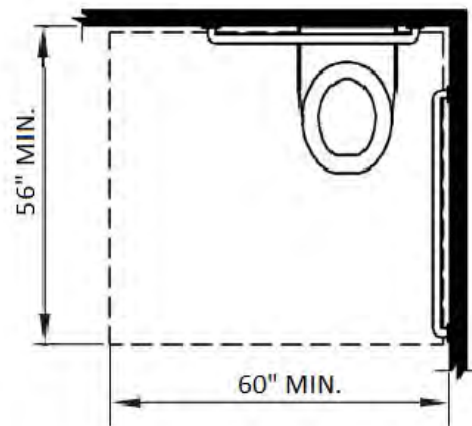
**FIGURE 11A-9A  
TOILET FACILITIES**



(a) SIDE VIEW

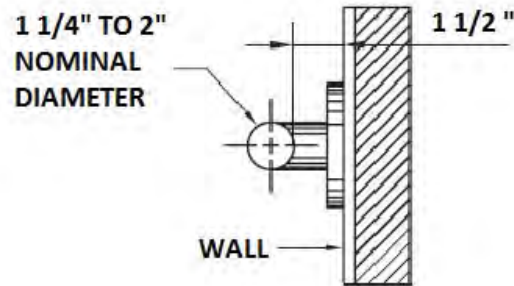


(b) FRONT VIEW

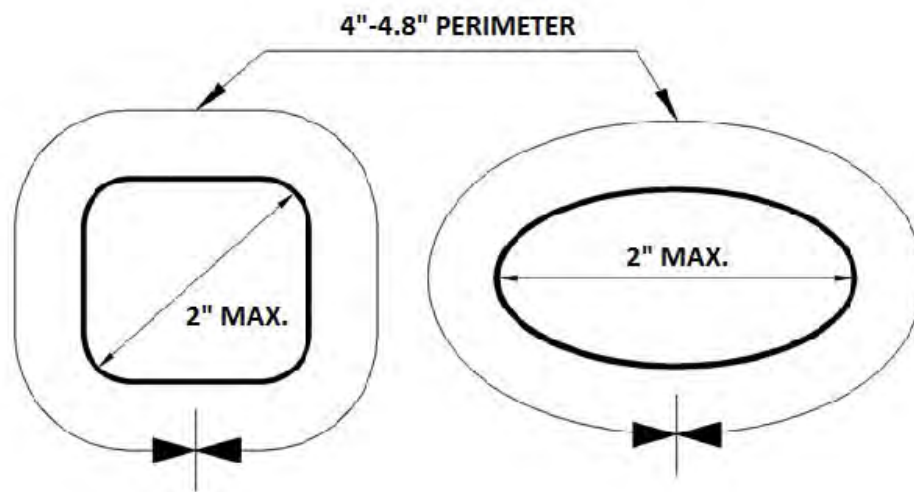


(c) CLEAR FLOOR SPACE AT WATER CLOSETS

FIGURE 11A-9B  
WATER CLOSETS

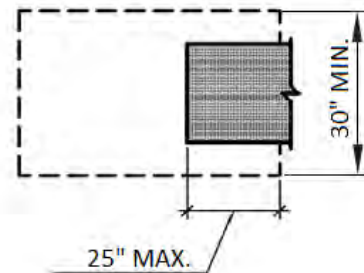
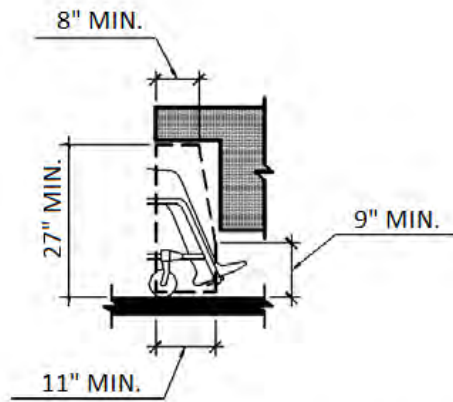


(a) SECTION THROUGH TYPICAL CIRCULAR GRAB BAR

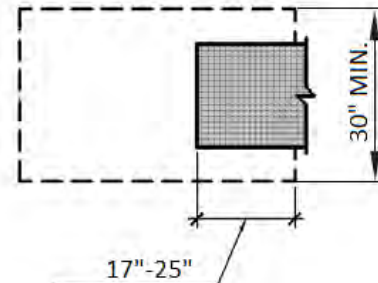
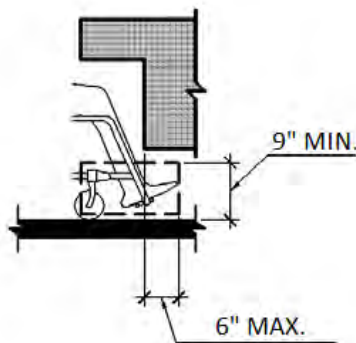


(b) NON-CIRCULAR CROSS SECTIONS

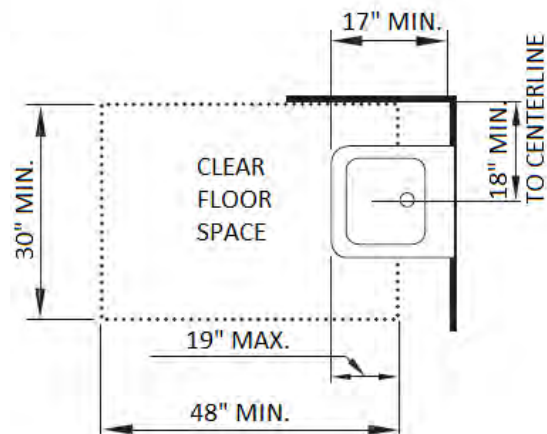
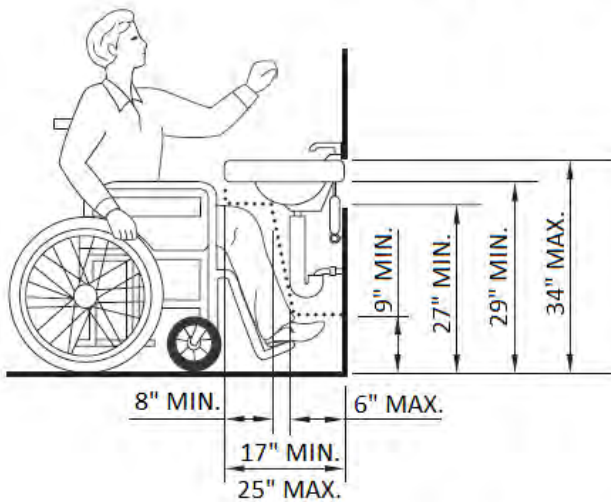
FIGURE 11A-9C  
GRAB BARS



(a) KNEE SPACE - GENERAL REQUIREMENT

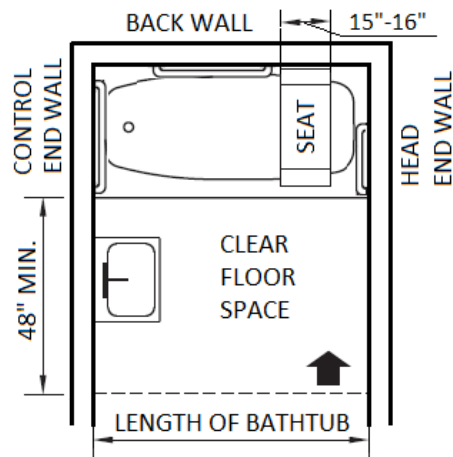


(b) TOE SPACE - GENERAL REQUIREMENT

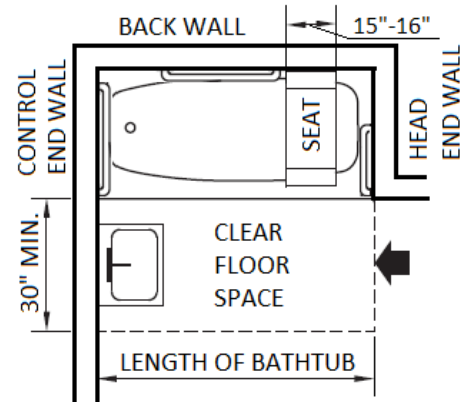


(c) KNEE AND TOE SPACE FOR LAVATORIES

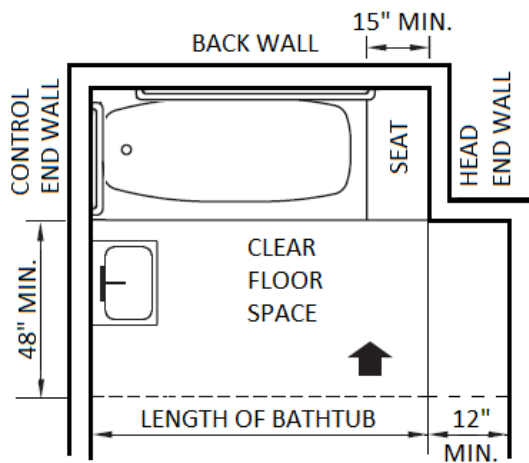
FIGURE 11A-9D  
KNEE AND TOE SPACE



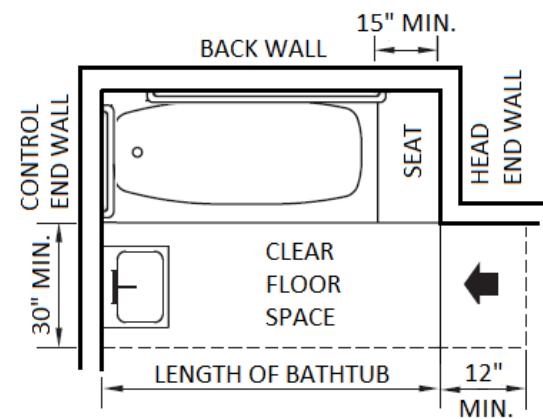
(a) REMOVABLE SEAT IN TUB - FRONT APPROACH



(b) REMOVABLE SEAT IN TUB - SIDE APPROACH



(c) PERMANENT SEAT IN TUB - FRONT APPROACH

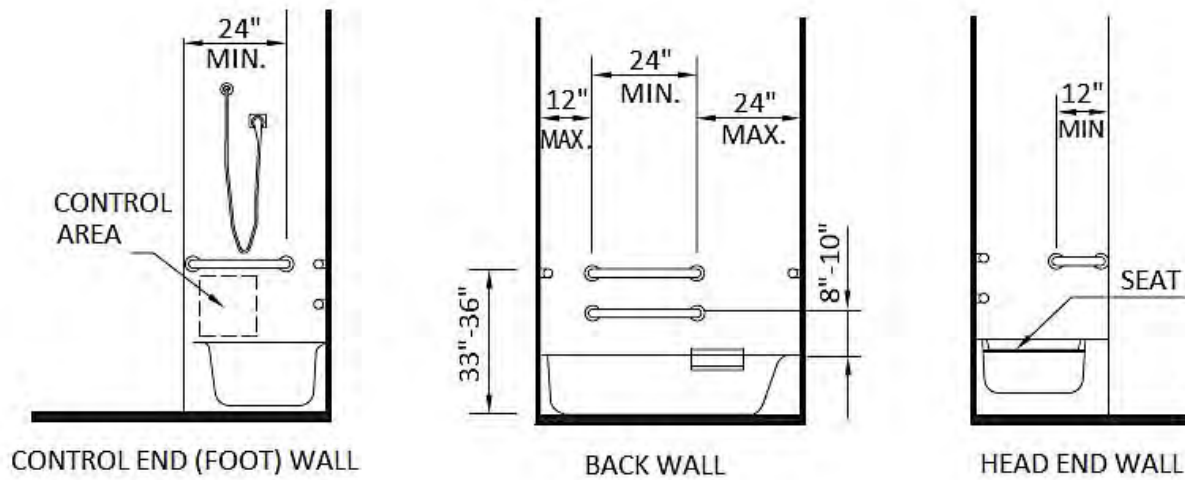


(d) PERMANENT SEAT IN TUB - SIDE APPROACH

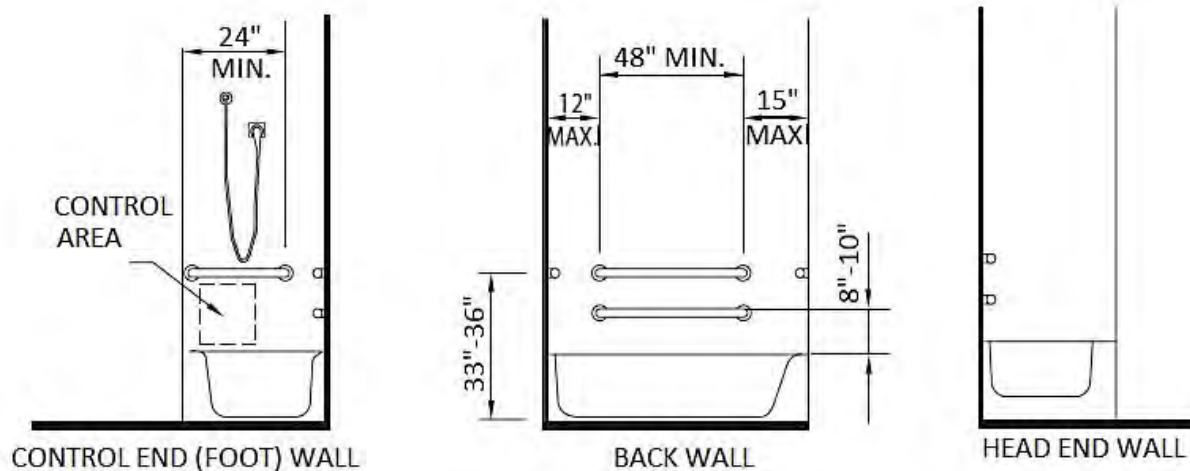
**NOTE:** SEE FIGURE 11A-9F FOR SIZE OF GRAB BARS

**FIGURE 11A-9E  
CLEAR FLOOR SPACE AT BATHTUBS**





(a) WITH REMOVABLE SEAT IN TUB



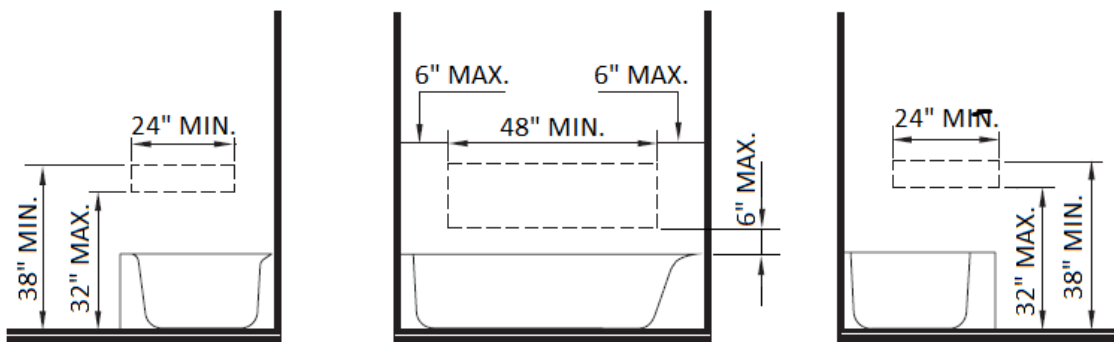
(b) WITH PERMANENT SEAT AT HEAD OF TUB

FIGURE 11A-9F  
GRAB BARS AT BATHTUBS

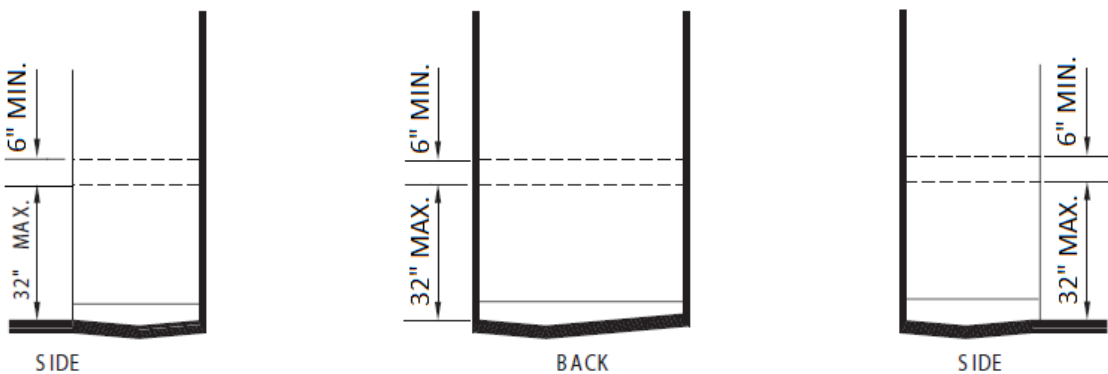




(a) GRAB BAR REINFORCEMENT FOR ADAPTABLE WATER CLOSETS



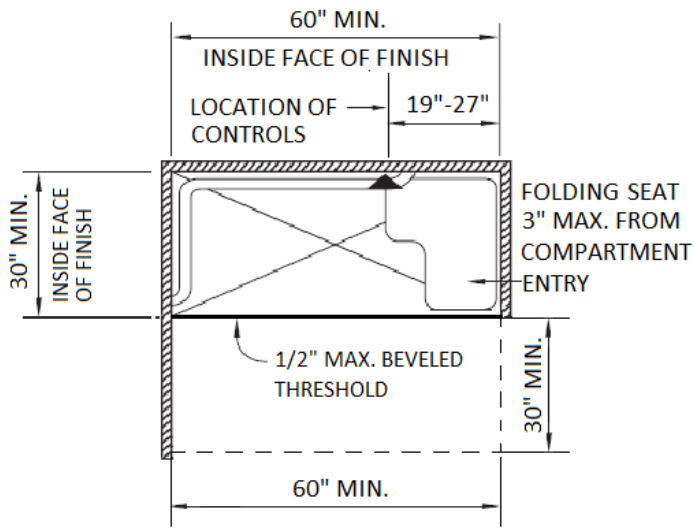
(b) GRAB BAR REINFORCEMENT FOR ADAPTABLE BATHTUBS



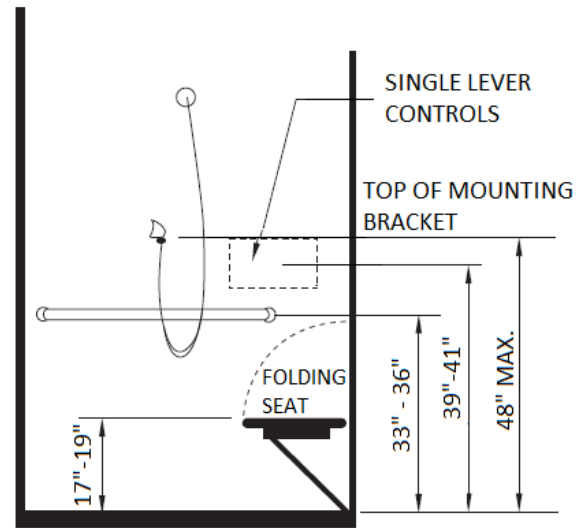
(c) GRAB BAR REINFORCEMENT FOR ADAPTABLE SHOWERS

AREAS OUTLINED IN DASHED LINES REPRESENT LOCATION FOR FUTURE INSTALLATION OF GRAB BARS

FIGURE 11A-9G  
REINFORCEMENT FOR GRAB BARS

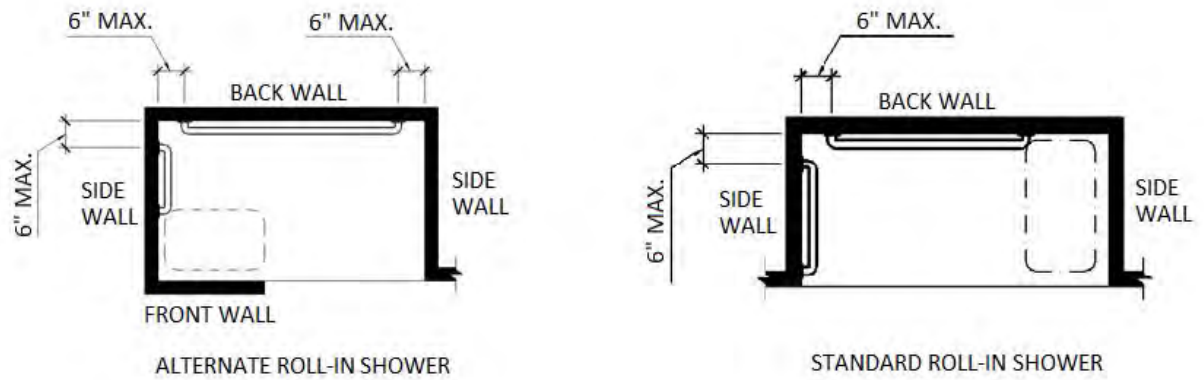


(a) 60" x 30" ROLL-IN SHOWER



(b) 42" x 48" ROLL-IN SHOWER

FIGURE 11A-9H  
STANDARD ROLL-IN SHOWER

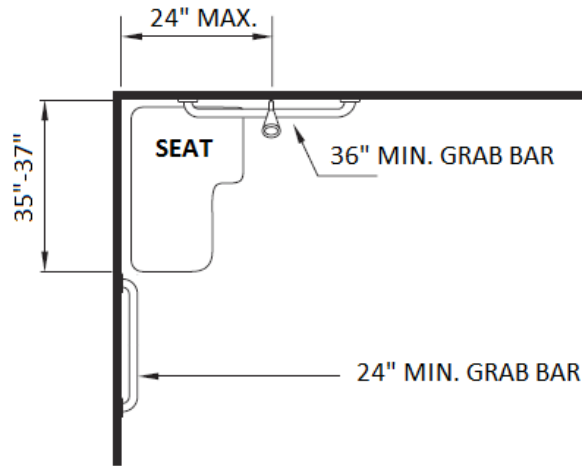


(a) GRAB BARS

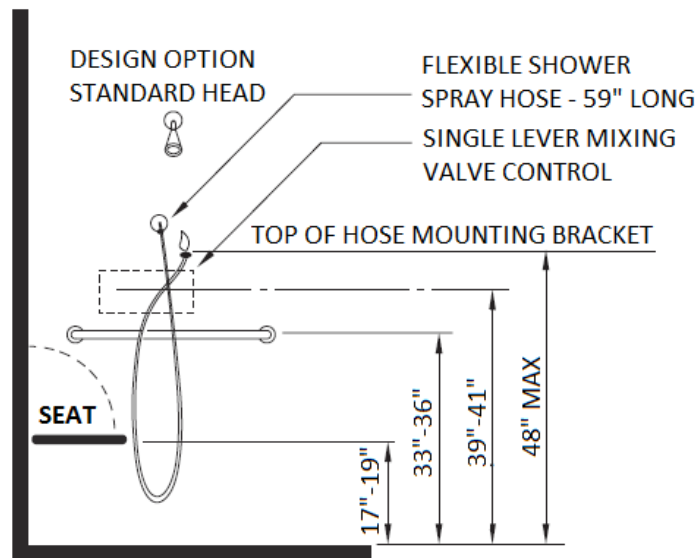


(b) SHOWER SEATS

FIGURE 1A-9I  
SHOWER SEATS AND GRAB BARS

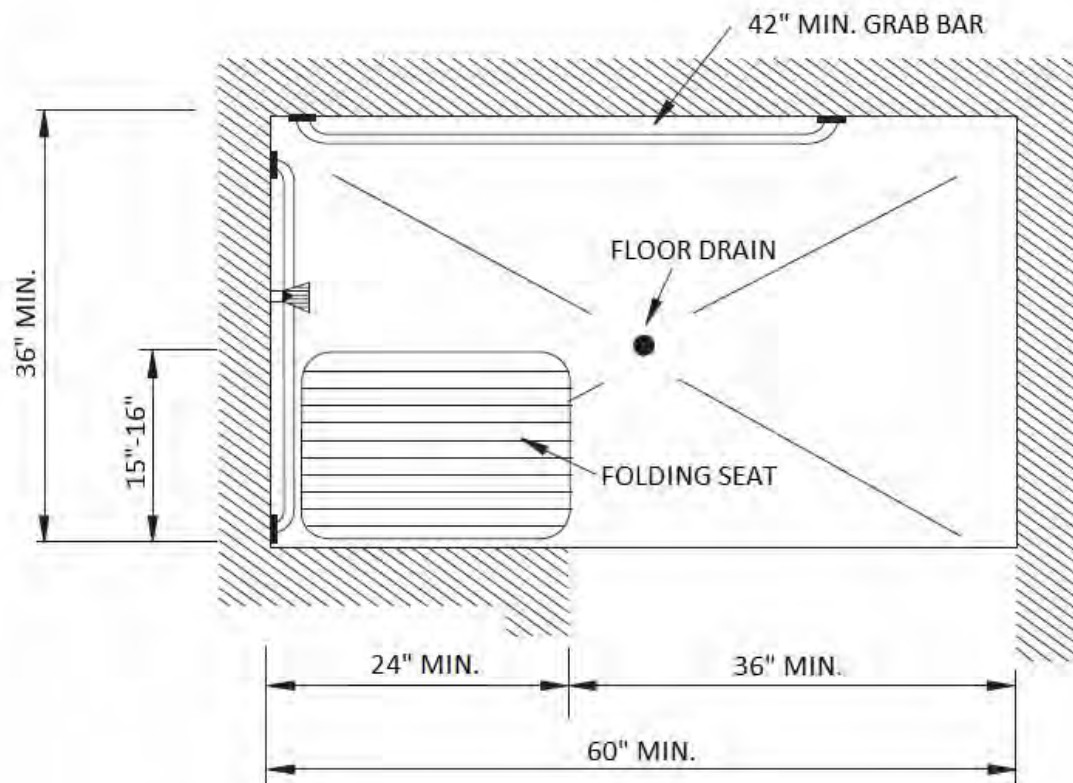


(a) PLAN VIEW



(b) ELEVATION

FIGURE 11A-9J  
OPEN SHOWER



**FIGURE 11A-9K**  
**ALTERNATE ROLL-IN SHOWER**

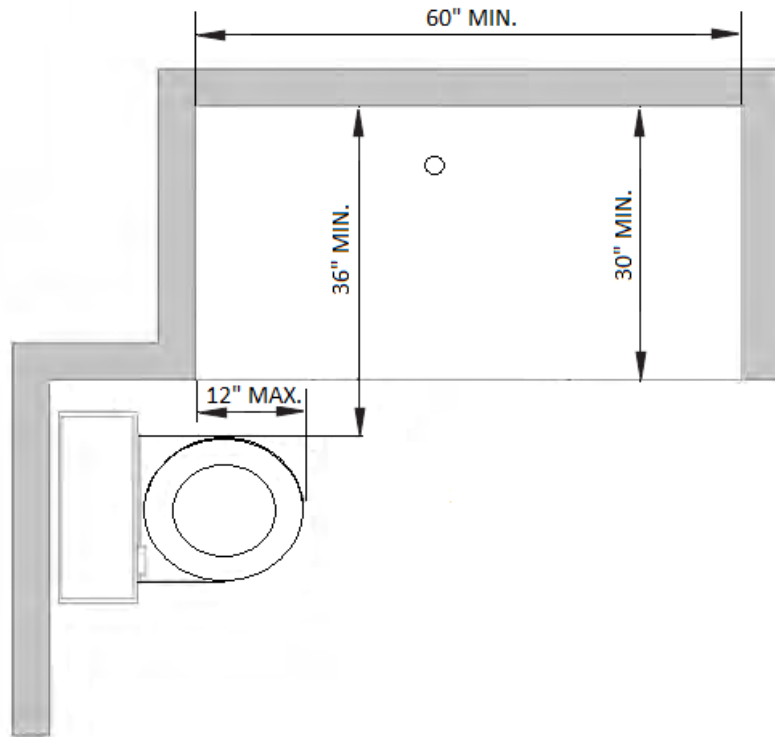


FIGURE 11A-9L  
SHOWER WITH WATER CLOSET

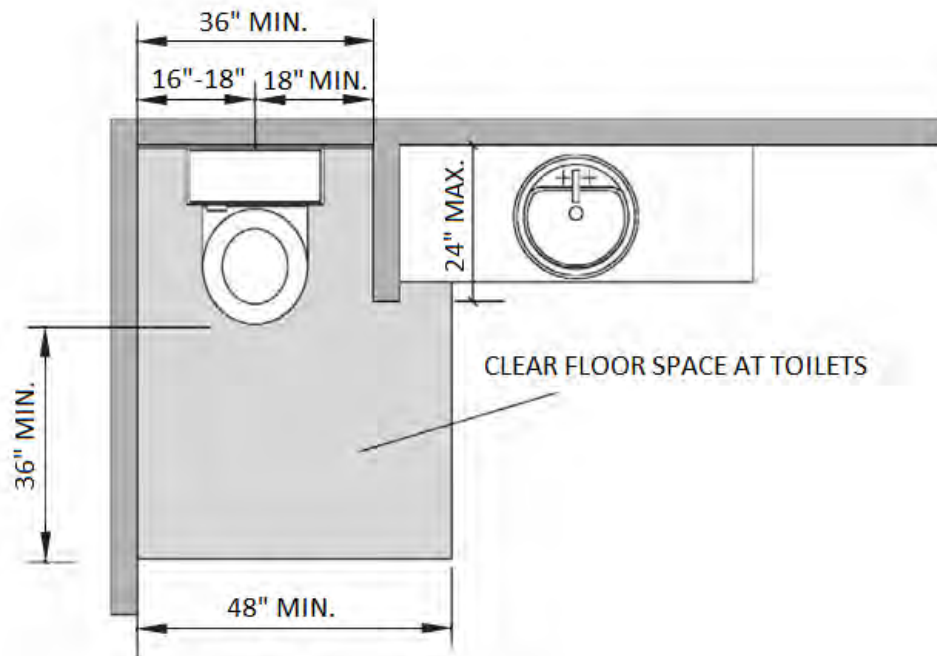
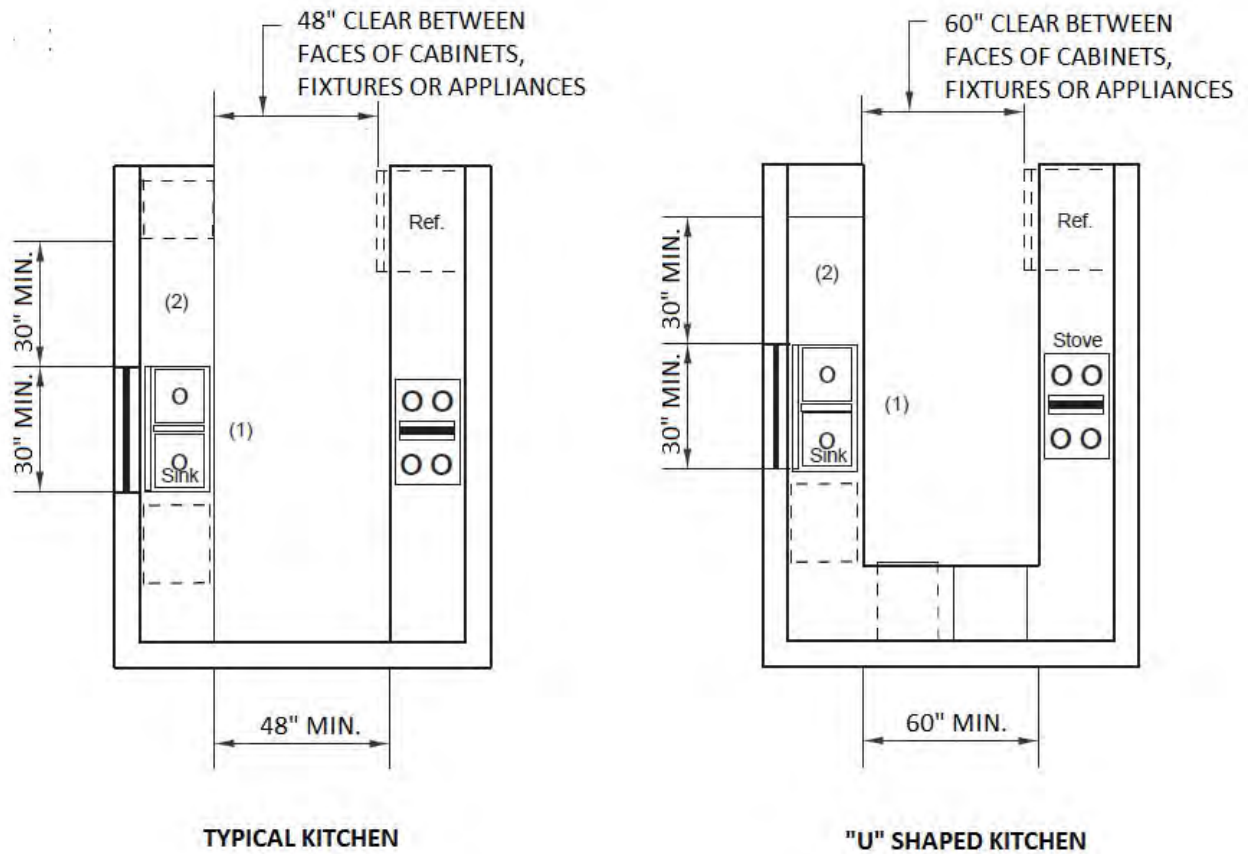


FIGURE 11A-9M  
WING WALL OR CABINET AT WATER CLOSET



- (1) 30-inch wide counter top space for sink installation with removable base cabinet and finish flooring beneath the sink
- (2) 30-inch wide counter top workspace
- (3) 30-inch by 48-inch clear space adjacent to range or cooktop to allow parallel approach
- (4) 30-inch by 48-inch either parallel approach at oven, dishwasher, trash compactor or refrigerator

**FIGURE 11A-10A**  
**KITCHEN SPECIFICATIONS**

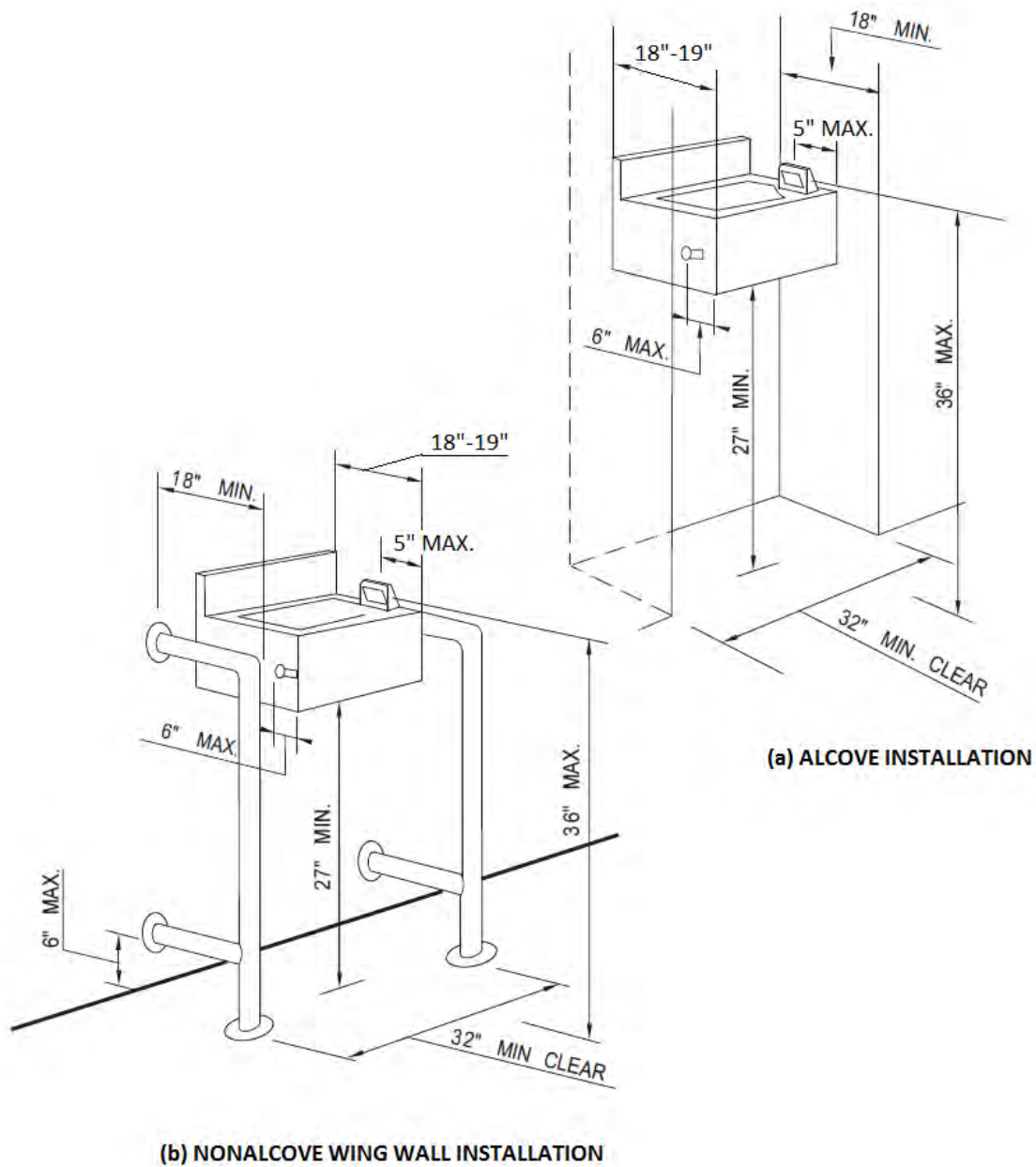
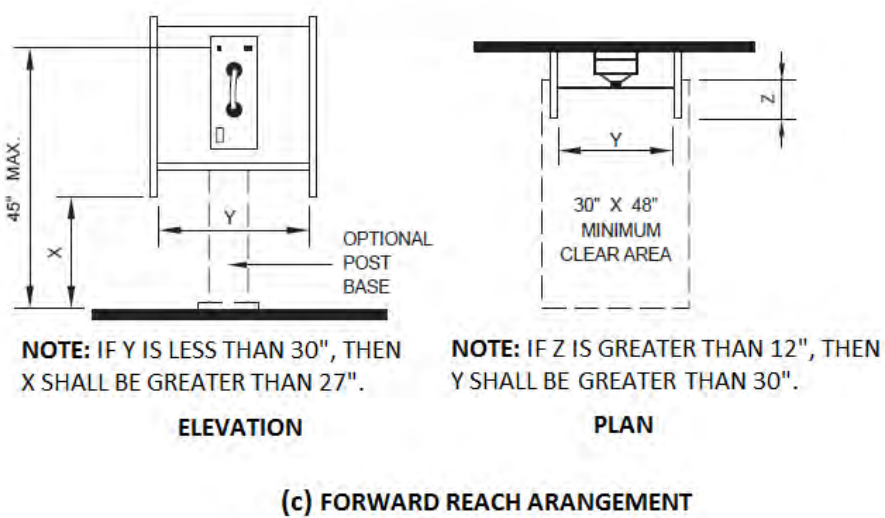
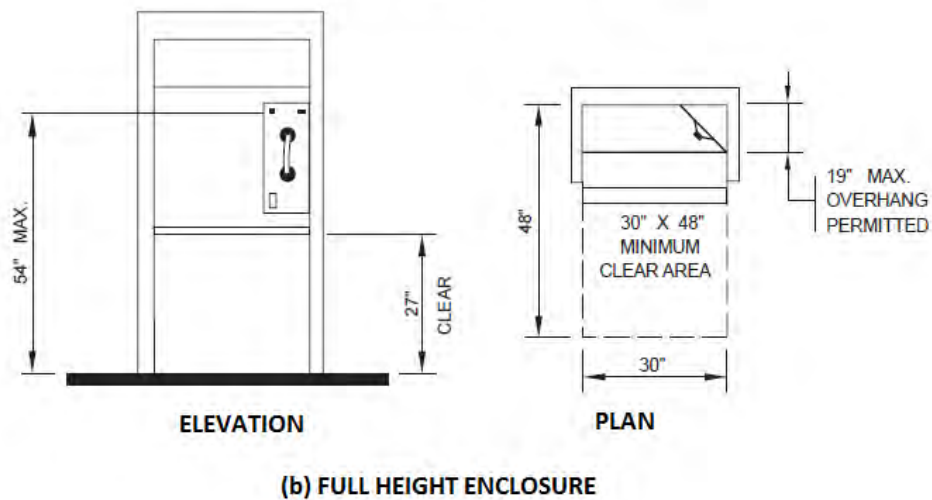
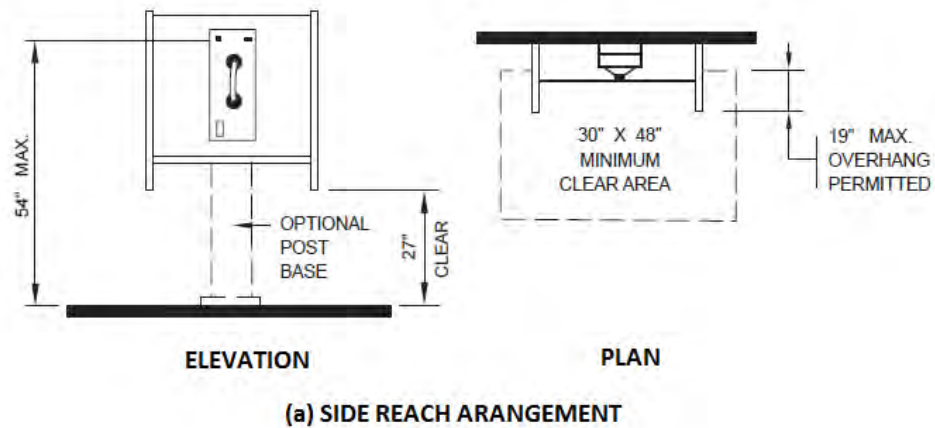


FIGURE 11A-11A  
DRINKING FOUNTAINS





**FIGURE 11A-11B**  
**MOUNTING HEIGHTS AND CLEARANCES FOR TELEPHONES**



**FIGURE 11A-11C**  
**INTERNATIONAL TTY SYMBOL**



**FIGURE 11A-1D**  
**VOLUME CONTROL TELEPHONES**



**FIGURE 11A-1E**  
**INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS**

**FIGURE 11A-1E**  
**INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS**

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE**  
**CHAPTER 11B – ACCESSIBILITY TO PUBLIC BUILDINGS, PUBLIC ACCOMMODATIONS,**  
**COMMERCIAL BUILDINGS AND PUBLICLY FUNDED HOUSING**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter						X														
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter / Section																				



## CHAPTER 11B

# ACCESSIBILITY TO PUBLIC BUILDINGS, PUBLIC ACCOMMODATIONS, COMMERCIAL BUILDINGS AND PUBLIC HOUSING

## DIVISION 1: APPLICATION AND ADMINISTRATION

### 11B-101 Purpose

**11B-101.1 General.** This *chapter* contains scoping and technical requirements for accessibility to sites, facilities, buildings, and elements by individuals with disabilities. The requirements are to be applied during the design, construction, additions to, and alteration of sites, facilities, buildings, and elements to the extent required by *Chapter 1, Section 1.9*.

### 11B-101.2 Reserved.

**11B-102 Dimensions for adults and children.** The technical requirements are based on adult dimensions and anthropometrics. In addition, this *chapter* includes technical requirements based on children's dimensions and anthropometrics for drinking fountains, water closets, toilet compartments, lavatories and sinks, dining surfaces, and work surfaces.

**11B-103 Equivalent facilitation.** Nothing in these requirements prevents the use of designs, products, or technologies as alternatives to those prescribed, provided they result in substantially equivalent or greater accessibility and usability.

### 11B-104 Conventions

**11B-104.1 Dimensions.** Dimensions that are not stated as "maximum" or "minimum" are absolute.

**11B-104.1.1 Construction and manufacturing tolerances.** All dimensions are subject to conventional industry tolerances except where the requirement is stated as a range with specific minimum and maximum end points.

**11B-104.2 Calculation of percentages.** Where the required number of elements or facilities to be provided is determined by calculations of ratios or percentages and remainders or fractions result, the next greater whole number of such elements or facilities shall be provided. Where the determination of the required size or dimension of an element or facility involves ratios or percentages, rounding down for values less than one half shall be permitted.

**11B-104.3 Figures.** Unless specifically stated otherwise, figures are provided for informational purposes only.

### 11B-105 Referenced standards.

**11B-105.1 General.** See *Chapter 35*.

### 11B-106 Definitions

**11B-106.1 General.** For the purpose of this *chapter*, the terms listed in Section 11B-106.5 and defined in *Chapter 2* have the indicated meaning.

**11B-106.2 Terms defined in referenced standards.** Terms not listed in *Section 11B-106.5* and not defined in *Chapter 2, Section 202*, but specifically defined in a referenced standard, shall have the specified meaning from the referenced standard unless otherwise stated.

**11B-106.3 Undefined terms.** The meaning of terms not specifically listed in *Section 11B-106.5*, and not defined in *Chapter 2, Section 202*, or in referenced standards shall be as defined by collegiate dictionaries in the sense that the context implies.

**11B-106.4 Interchangeability.** See *Chapter 2, Section 201.2*.








Convention	Description
	dimension showing English units (inches unless otherwise specified) above the line and SI units (in millimeters unless otherwise specified) below the line
	dimension for small measurements
	dimension showing a range with minimum - maximum
min	minimum
max	maximum
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
----	boundary of clear floor space or maneuvering clearance
---○---	centerline
---	a permitted element or its extension
	direction of travel or approach
	a wall, floor, ceiling or other element cut in section or plan
	a highlighted element in elevation or plan
	location zone of element, control or feature

FIGURE 11B-104  
GRAPHIC CONVENTION FOR FIGURES

***11B-106.5 Defined terms.*** *The following terms are defined in Chapter 2, Section 202.*

<b><i>ACCESS AISLE</i></b>	<b><i>CROSS SLOPE</i></b>
<b><i>ACCESSIBILITY</i></b>	<b><i>CURB CUT</i></b>
<b><i>ACCESSIBLE</i></b>	<b><i>CURB RAMP</i></b>
<b><i>ACCESSIBLE ELEMENT</i></b>	<b><i>DETECTABLE WARNING</i></b>
<b><i>ACCESSIBLE MEANS OF EGRESS</i></b>	<b><i>DIRECTIONAL SIGN</i></b>
<b><i>ACCESSIBLE ROUTE</i></b>	<b><i>DISABILITY</i></b>
<b><i>ACCESSIBLE SPACE</i></b>	<b><i>DORMITORY</i></b>
<b><i>ADAPTABLE</i></b>	<b><i>ELEMENT</i></b>
<b><i>ADDITION</i></b>	<b><i>ELEVATED PLAY COMPONENT</i></b>
<b><i>ADMINISTRATIVE AUTHORITY</i></b>	<b><i>ELEVATOR, PASSENGER</i></b>
<b><i>AISLE</i></b>	<b><i>EMPLOYEE WORK AREA</i></b>
<b><i>ALTERATION</i></b>	<b><i>ENFORCING AGENCY</i></b>
<b><i>AMUSEMENT ATTRACTION</i></b>	<b><i>ENTRANCE</i></b>
<b><i>AMUSEMENT RIDE</i></b>	<b><i>EQUIVALENT FACILITATION</i></b>
<b><i>AMUSEMENT RIDE SEAT</i></b>	<b><i>EXISTING BUILDING OR FACILITY</i></b>
<b><i>ANSI</i></b>	<b><i>EXIT</i></b>
<b><i>APPROVED</i></b>	<b><i>FACILITY</i></b>
<b><i>APPROVED TESTING AGENCY</i></b>	<b><i>FUNCTIONAL AREA</i></b>
<b><i>AREA OF REFUGE</i></b>	<b><i>GANGWAY</i></b>
<b><i>AREA OF SPORT ACTIVITY</i></b>	<b><i>GOLF CAR PASSAGE</i></b>
<b><i>ASSEMBLY AREA</i></b>	<b><i>GRAB BAR</i></b>
<b><i>ASSISTIVE LISTENING SYSTEM (ALS)</i></b>	<b><i>GRADE (ADJACENT GROUND ELEVATION)</i></b>
<b><i>AUTOMATIC DOOR</i></b>	<b><i>GRADE BREAK</i></b>
<b><i>AUTOMATIC TELLER MACHINE (ATM)</i></b>	<b><i>GROUND FLOOR</i></b>
<b><i>BATHROOM</i></b>	<b><i>GROUND LEVEL PLAY COMPONENT</i></b>
<b><i>BLENDED TRANSITION</i></b>	<b><i>GUARD</i></b>
<b><i>BOARDING PIER</i></b>	<b><i>HANDRAIL</i></b>
<b><i>BOAT LAUNCH RAMP</i></b>	<b><i>HEALTH CARE PROVIDER</i></b>
<b><i>BOAT SLIP</i></b>	<b><i>HISTORICAL BUILDINGS</i></b>
<b><i>BUILDING</i></b>	<b><i>HOUSING AT A PLACE OF EDUCATION</i></b>
<b><i>BUILDING OFFICIAL</i></b>	<b><i>IF, IF . . . THEN</i></b>
<b><i>CATCH POOL</i></b>	<b><i>INTERNATIONAL SYMBOL OF ACCESSIBILITY</i></b>
<b><i>CCR</i></b>	<b><i>KEY STATION</i></b>
<b><i>CHARACTERS</i></b>	<b><i>KICK PLATE</i></b>
<b><i>CHILDREN'S USE</i></b>	<b><i>KITCHEN OR KITCHENETTE</i></b>
<b><i>CIRCULATION PATH</i></b>	<b><i>LAVATORY</i></b>
<b><i>CLEAR</i></b>	<b><i>MAIL BOXES</i></b>
<b><i>CLEAR FLOOR SPACE</i></b>	<b><i>MARKED CROSSING</i></b>
<b><i>CLOSED-CIRCUIT TELEPHONE</i></b>	<b><i>MAY</i></b>
<b><i>COMMERCIAL FACILITIES</i></b>	<b><i>MEZZANINE</i></b>
<b><i>COMMON USE</i></b>	<b><i>NFPA</i></b>
<b><i>COMPLY WITH</i></b>	<b><i>NOSING</i></b>
	<b><i>OCCUPANT LOAD</i></b>
	<b><i>OCCUPIABLE SPACE</i></b>

<i>OPEN RISER</i>	<i>SIDEWALK</i>
<i>OPERABLE PART</i>	<i>SIGNAGE</i>
<i>PASSENGER ELEVATOR</i>	<i>SINK</i>
<i>PATH OF TRAVEL</i>	<i>SITE</i>
<i>PEDESTRIAN</i>	<i>SLEEPING ACCOMMODATIONS</i>
<i>PEDESTRIAN WAY</i>	<i>SOFT CONTAINED PLAY STRUCTURE</i>
<i>PERMANENT</i>	<i>SPACE</i>
<i>PERMIT</i>	<i>SPECIFIED PUBLIC TRANSPORTATION</i>
<i>PICTOGRAM</i>	<i>STAGE</i>
<i>PLACE OF PUBLIC ACCOMMODATION</i>	<i>STAIR</i>
<i>PLATFORM</i>	<i>STAIRWAY</i>
<i>PLATFORM (WHEELCHAIR) LIFT</i>	<i>STORY</i>
<i>PLAY AREA</i>	<i>STRUCTURAL FRAME</i>
<i>PLAY COMPONENT</i>	<i>STRUCTURE</i>
<i>POINT-OF-SALE DEVICE</i>	<i>TACTILE</i>
<i>POWDER ROOM</i>	<i>TACTILE SIGN</i>
<i>POWER-ASSISTED DOOR</i>	<i>TECHNICALLY INFEASIBLE</i>
<i>PRIVATE BUILDING OR FACILITY</i>	<i>TEEING GROUND</i>
<i>PROFESSIONAL OFFICE OF A HEALTH CARE PROVIDER</i>	<i>TEMPORARY</i>
<i>PUBLIC BUILDING OR FACILITY</i>	<i>TEXT TELEPHONE</i>
<i>PUBLIC ENTITY</i>	<i>TRANSFER DEVICE</i>
<i>PUBLIC ENTRANCE</i>	<i>TRANSIENT LODGING</i>
<i>PUBLIC HOUSING</i>	<i>TRANSIT BOARDING PLATFORM</i>
<i>PUBLIC USE</i>	<i>TRANSITION PLATE</i>
<i>PUBLIC-USE AREAS</i>	<i>TREAD</i>
<i>PUBLIC WAY</i>	<i>TTY</i>
<i>QUALIFIED HISTORIC BUILDING OR FACILITY</i>	<i>UNREASONABLE HARDSHIP</i>
<i>RAMP</i>	<i>USE ZONE</i>
<i>REASONABLE PORTION</i>	<i>VALUATION THRESHOLD</i>
<i>RECOMMEND</i>	<i>VEHICULAR WAY</i>
<i>REMODELING</i>	<i>WALK</i>
<i>REPAIR</i>	<i>WET BAR</i>
<i>RESIDENTIAL DWELLING UNIT</i>	<i>WHEELCHAIR</i>
<i>RESTRICTED ENTRANCE</i>	<i>WHEELCHAIR SPACE</i>
<i>RISER</i>	<i>WORKSTATION</i>
<i>RUNNING SLOPE</i>	<i>WORK AREA EQUIPMENT</i>
<i>SELF-SERVICE STORAGE</i>	<i>11B-107 Special conditions appeals action. See Chapter 1, Section 1.9.1.5.</i>
<i>SERVICE ENTRANCE</i>	<i>11B-108 Maintenance of accessible features. A public accommodation shall maintain in operable working condition those features of facilities and equipment that are required to be accessible to and useable by persons with disabilities. Isolated or temporary interruptions in service or accessibility due to maintenance or repairs shall be permitted.</i>
<i>SHALL</i>	
<i>SHOPPING CENTER (OR SHOPPING MALL)</i>	
<i>SHOULD</i>	

## DIVISION 2: SCOPING REQUIREMENTS

### **11B-201 Application**

**11B-201.1 Scope.** All areas of newly designed and newly constructed buildings and facilities and altered portions of existing buildings and facilities shall comply with these requirements.

**11B-201.2 Application based on building or facility use.** Where a site, building, facility, room, or space contains more than one use, each portion shall comply with the applicable requirements for that use.

**11B-201.3 Temporary and permanent structures.** These requirements shall apply to temporary and permanent buildings and facilities.

**11B-201.4 Construction support facilities.** These requirements shall apply to temporary or permanent construction support facilities for uses and activities not directly associated with the actual processes of construction, including but not limited to offices, meeting rooms, plan rooms, other administrative or support functions. When provided, toilet and bathing facilities serving construction support facilities shall comply with Section 11B-213. When toilet and bathing facilities serving construction support facilities are provided by portable units, at least one of each type shall be accessible and connected to the construction support facilities it serves by an accessible route.

**Exception:** During construction an accessible route shall not be required between site arrival points or the boundary of the area of construction and the entrance to the construction support facilities if the only means of access between them is a vehicular way not providing pedestrian access.

### **11B-202 Existing buildings and facilities**

**11B-202.1 General.** Additions and alterations to existing buildings or facilities shall comply with Section 11B-202.

**11B-202.2 Additions.** Each addition to an existing building or facility shall comply with the requirements for new construction and shall comply with Section 11B-202.4.

**11B-202.3 Alterations.** Where existing elements or spaces are altered, each altered element or space shall comply with the applicable requirements of Division 2, including Section 11B-202.4.

#### **Exceptions:**

1. **Reserved.**
2. **Technically infeasible.** In alterations, where the enforcing authority determines compliance with applicable requirements is technically infeasible, the alteration shall provide equivalent facilitation or comply with the requirements to the maximum extent feasible. The details of the finding that full compliance with the requirements is technically infeasible shall be recorded and entered into the files of the enforcing agency.

3. Residential dwelling units not required to be accessible in compliance with *this code* shall not be required to comply with Section 11B-202.3.

**11B-202.3.1 Prohibited reduction in access.** An alteration that decreases or has the effect of decreasing the accessibility of a building or facility below the requirements for new construction at the time of the alteration is prohibited.

**11B-202.3.2 Extent of application.** An alteration of an existing element, space, or area of a building or facility shall not impose a requirement for accessibility greater than required for new construction.

**11B-202.3.3 Alteration of single elements.** If alterations of single elements, when considered together, amount to an alteration of a room or space in a building or facility, the entire room or space shall be made accessible.

**11B-202.4 Path of travel requirements in alterations, additions and structural repairs.** When alterations or additions are made to existing buildings or facilities, an accessible path of travel to the specific area of alteration or addition shall be provided. The primary accessible path of travel shall include:

1. A primary entrance to the building or facility,
2. Toilet and bathing facilities serving the area,
3. Drinking fountains serving the area,
4. Public telephones serving the area, and
5. Signs.

#### **Exceptions:**

1. Residential dwelling units shall comply with Section 11B-233.3.4.2.
2. If the following elements of a path of travel have been constructed or altered in compliance with the accessibility requirements of the immediately preceding edition of the California Building Code, it shall not be required to retrofit such elements to reflect the incremental changes in this code solely because of an alteration to an area served by those elements of the path of travel:
  1. A primary entrance to the building or facility,
  2. Toilet and bathing facilities serving the area,
  3. Drinking fountains serving the area,
  4. Public telephones serving the area, and
  5. Signs.
3. Additions or alterations to meet accessibility requirements consisting of one or more of the following items shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4:
  1. Altering one building entrance.
  2. Altering one existing toilet facility.



3. Altering existing elevators.
4. Altering existing steps.
5. Altering existing handrails.
4. Alterations solely for the purpose of barrier removal undertaken pursuant to the requirements of the Americans with Disabilities Act (Public Law 101-336, 28 C.F.R., Section 36.304) or the accessibility requirements of this code as those requirements or regulations now exist or are hereafter amended consisting of one or more of the following items shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4:
  1. Installing ramps.
  2. Making curb cuts in sidewalks and entrance.
  3. Repositioning shelves.
  4. Rearranging tables, chairs, vending machines, display racks, and other furniture.
  5. Repositioning telephones.
  6. Adding raised markings on elevator control buttons.
  7. Installing flashing alarm lights.
  8. Widening doors.
  9. Installing offset hinges to widen doorways.
  10. Eliminating a turnstile or providing an alternative accessible route.
  11. Installing accessible door hardware.
  12. Installing grab bars in toilet stalls.
  13. Rearranging toilet partitions to increase maneuvering space.
  14. Insulating lavatory pipes under sinks to prevent burns.
  15. Installing a raised toilet seat.
  16. Installing a full-length bathroom mirror.
  17. Repositioning the paper towel dispenser in a bathroom.
  18. Creating designated accessible parking spaces.
  19. Removing high-pile, low-density carpeting.
5. Alterations of existing parking lots by resurfacing and/or restriping shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4.
6. The addition or replacement of signs and/or identification devices shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4.
7. Projects consisting only of heating, ventilation, air conditioning, reroofing, electrical work not involving placement of switches and receptacles, cosmetic work that does not affect items regulated by this

code, such as painting, equipment not considered to be a part of the architecture of the building or area, such as computer terminals and office equipment shall not be required to comply with Section 11B-202.4 unless they affect the usability of the building or facility.

8. When the adjusted construction cost is less than or equal to the current valuation threshold, as defined in Chapter 2, Section 202, the cost of compliance with Section 11B-202.4 shall be limited to 20 percent of the adjusted construction cost of alterations, structural repairs or additions. When the cost of full compliance with Section 11B-202.4 would exceed 20 percent, compliance shall be provided to the greatest extent possible without exceeding 20 percent.

When the adjusted construction cost exceeds the current valuation threshold, as defined in Chapter 2, Section 202, and the enforcing agency determines the cost of compliance with Section 11B-202.4 is an unreasonable hardship, as defined in Chapter 2, Section 202, full compliance with Section 11B-202.4 shall not be required. Compliance shall be provided by equivalent facilitation or to the greatest extent possible without creating an unreasonable hardship; but in no case shall the cost of compliance be less than 20 percent of the adjusted construction cost of alterations, structural repairs or additions. The details of the finding of unreasonable hardship shall be recorded and entered into the files of the enforcing agency and shall be subject to Chapter 1, Section 1.9.1.5, Special Conditions for Persons with Disabilities Requiring Appeals Action Ratification.

For the purposes of this exception, the adjusted construction cost of alterations, structural repairs or additions shall not include the cost of alterations to path of travel elements required to comply with Section 11B-202.4.

In choosing which accessible elements to provide, priority should be given to those elements that will provide the greatest access in the following order:

1. An accessible entrance;
2. An accessible route to the altered area;
3. At least one accessible restroom for each sex;
4. Accessible telephones;
5. Accessible drinking fountains; and
6. When possible, additional accessible elements such as parking, storage and alarms.

If an area has been altered without providing an accessible path of travel to that area, and subsequent alterations of that area or a different area on the same path of travel are undertaken within three years of the original alteration, the total cost of alterations to the areas on that path of travel during the preceding three-year period shall be considered in determining whether the cost of making that path of travel accessible is disproportionate.

9. *Certain types of privately funded, multistory buildings and facilities were formerly exempt from accessibility requirements above and below the first floor under this code, but as of April 1, 1994 are no longer exempt due to more restrictive provisions in the federal Americans with Disabilities Act. In alteration projects involving buildings and facilities previously approved and built without elevators, areas above and below the ground floor are subject to the 20-percent disproportionately provisions described in Exception 8, above, even if the value of the project exceeds the valuation threshold in Exception 8. The types of buildings and facilities are:*

1. *Office buildings and passenger vehicle service stations of three stories or more and 3,000 or more square feet (279 m<sup>2</sup>) per floor.*
2. *Offices of physicians and surgeons.*
3. *Shopping centers.*
4. *Other buildings and facilities three stories or more and 3,000 or more square feet (279 m<sup>2</sup>) per floor if a reasonable portion of services sought and used by the public is available on the accessible level.*

*For the general privately funded multistory building exception applicable to new construction and alterations, see Section 11B-206.2.3, Exception 1.*

*The elevator exception set forth in this section does not obviate or limit in any way the obligation to comply with the other accessibility requirements in this code. For example, floors above or below the accessible ground floor must meet the requirements of this section except for elevator service. If toilet or bathing facilities are provided on a level not served by an elevator, then toilet or bathing facilities must be provided on the accessible ground floor.*

**11B-202.5 Alterations to qualified historic buildings and facilities.** Alterations to a qualified historic building or facility shall comply with the *State Historical Building Code, Part 8, Title 24, of the California Code of Regulations.*

**Exception: Reserved.**

### **11B-203 General exceptions**

**11B-203.1 General.** Sites, buildings, facilities, and elements are exempt from these requirements to the extent specified by 11B-203.

**11B-203.2 Construction sites.** Structures and sites directly associated with the actual processes of construction, including but not limited to, scaffolding, bridging, materials hoists, materials storage and construction trailers shall not be required to comply with these requirements or to be on an accessible route. Portable toilet units provided for use exclusively by construction personnel on a construction site shall not be required to comply with Section 11B-213 or to be on an accessible route.

**11B-203.3 Raised areas.** Areas raised primarily for purposes of security, life safety, or fire safety, including but not limited to, observation or lookout galleries, prison guard towers, fire

towers or life guard stands shall not be required to comply with these requirements or to be on an accessible route.

**11B-203.4 Limited access spaces.** Spaces *not customarily occupied and accessed only by ladders, catwalks, crawl spaces or very narrow passageways* shall not be required to comply with these requirements or to be on an accessible route.

**11B-203.5 Machinery spaces.** Spaces frequented only by service personnel for maintenance, repair or occasional monitoring of equipment shall not be required to comply with these requirements or to be on an accessible route. Machinery spaces include, but are not limited to, elevator pits or elevator penthouses; mechanical, electrical or communications equipment rooms; piping or equipment catwalks; water or sewage treatment pump rooms and stations; electric substations and transformer vaults; and highway and tunnel utility facilities.

**11B-203.6 Single occupant structures.** Single occupant structures accessed only by passageways below grade or elevated above standard curb height, including but not limited to, toll booths that are accessed only by underground tunnels, shall not be required to comply with these requirements or to be on an accessible route.

**11B-203.7 Detention and correctional facilities.** In detention and correctional facilities, common use areas that are used only by inmates or detainees and security personnel and that do not serve holding cells or housing cells required to comply with Section 11B-232, shall not be required to comply with these requirements or to be on an accessible route.

**11B-203.8 Residential facilities.** In *public housing* residential facilities, common use areas that do not serve residential dwelling units required to provide mobility features complying with Sections 11B-809.2 through 11B-809.4 and *adaptable features complying with Chapter 11A, Division IV* shall not be required to comply with these requirements or to be on an accessible route.

**11B-203.9 Employee work areas.** Spaces and elements within employee work areas shall only be required to comply with Sections 11B-206.2.8, 11B-207.1, and 11B-215.3 and shall be designed and constructed so that individuals with disabilities can approach, enter, and exit the employee work area.

**11B-203.10 Raised refereeing, judging and scoring areas.** Raised structures used solely for refereeing, judging or scoring a sport shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders, or other means of reaching the raised elements or areas.*

**11B-203.11 Water slides.** Water slides shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.*

**11B-203.12 Animal containment areas.** Animal containment areas that are not for public use shall not be required to comply with these requirements or to be on an accessible

route. *Animal containment areas for public use shall be on an accessible route.*

**11B-203.13 Raised boxing or wrestling rings.** Raised boxing or wrestling rings shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.*

**11B-203.14 Raised diving boards and diving platforms.** Raised diving boards and diving platforms shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.*

#### **11B-204 Protruding objects**

**11B-204.1 General.** Protruding objects on circulation paths shall comply with *Section 11B-307*.

##### **Exceptions:**

1. Within areas of sport activity, protruding objects on circulation paths shall not be required to comply with *Section 11B-307*.
2. Within play areas, protruding objects on circulation paths shall not be required to comply with *Section 11B-307* provided that ground level accessible routes provide vertical clearance in compliance with *Section 11B-1008.2*.

#### **11B-205 Operable parts**

**11B-205.1 General.** Operable parts on accessible elements, accessible routes, and in accessible rooms and spaces shall comply with *Section 11B-309*.

##### **Exceptions:**

1. Operable parts that are intended for use only by service or maintenance personnel shall not be required to comply with *Section 11B-309*.
2. Electrical or communication receptacles serving a dedicated use shall not be required to comply with *Section 11B-309*.
3. **Reserved.**
4. Floor electrical receptacles shall not be required to comply with *Section 11B-309*.
5. HVAC diffusers shall not be required to comply with *Section 11B-309*.
6. Except for light switches, where redundant controls are provided for a single element, one control in each space shall not be required to comply with *Section 11B-309*.
7. Cleats and other boat securement devices shall not be required to comply with *Section 11B-309.3*.
8. Exercise machines and exercise equipment shall not be required to comply with *Section 11B-309*.

#### **11B-206 Accessible routes**

**11B-206.1 General.** Accessible routes shall be provided in accordance with *Section 11B-206* and shall comply with *Division 4*.

**11B-206.2 Where required.** Accessible routes shall be provided where required by *Section 11B-206.2*.

**11B-206.2.1 Site arrival points.** At least one accessible route shall be provided within the site from accessible parking spaces and accessible passenger loading zones; public streets and sidewalks; and public transportation stops to the accessible building or facility entrance they serve. *Where more than one route is provided, all routes must be accessible.*

##### **Exceptions:**

1. **Reserved.**
2. An accessible route shall not be required between site arrival points and the building or facility entrance if the only means of access between them is a vehicular way not providing pedestrian access.
3. *General circulation paths shall be permitted when located in close proximity to an accessible route.*

**11B-206.2.2 Within a site.** At least one accessible route shall connect accessible buildings, accessible facilities, accessible elements, and accessible spaces that are on the same site.

**Exception:** An accessible route shall not be required between accessible buildings, accessible facilities, accessible elements, and accessible spaces if the only means of access between them is a vehicular way not providing pedestrian access.

**11B-206.2.3 Multi-story buildings and facilities.** At least one accessible route shall connect each story and mezzanine in multi-story buildings and facilities.

##### **Exceptions:**

1. *The following types of privately funded multi-story buildings do not require a ramp or elevator above and below the first floor:*
  - 1.1. *Multi-storied office buildings (other than the professional office of a health care provider) and passenger vehicle service stations less than three stories high or less than 3,000 square feet (279 m<sup>2</sup>) per story.*
  - 1.2. *Any other privately funded multi-storied building that is not a shopping center, shopping mall or the professional office of a health care provider, or a terminal, depot or other station used for specified public transportation, or an airport passenger terminal and that is less than three stories high or less than 3,000 square feet (279 m<sup>2</sup>) per story if a rea-*

*sonable portion of all facilities and accommodations normally sought and used by the public in such a building are accessible to and usable by persons with disabilities.*

**2. Reserved.**

3. In detention and correctional facilities, an accessible route shall not be required to connect stories where cells with mobility features required to comply with *Section 11B-807.2*, all common use areas serving cells with mobility features required to comply with *Section 11B-807.2*, and all public use areas are on an accessible route.
4. In residential facilities, an accessible route shall not be required to connect stories where residential dwelling units with mobility features required to comply with *Sections 11B-809.2 through 11B-809.4*, *residential dwelling units with adaptable features complying with Chapter 11A, Division IV*, all common use areas serving residential dwelling units with mobility features required to comply with *Sections 11B-809.2 through 11B-809.4*, *all common use areas serving residential dwelling units with adaptable features complying with Chapter 11A, Division IV*, and public use areas serving residential dwelling units are on an accessible route.
5. Within multi-story transient lodging guest rooms with mobility features required to comply with *Section 11B-806.2*, an accessible route shall not be required to connect stories provided that spaces complying with *Section 11B-806.2* are on an accessible route and sleeping accommodations for two persons minimum are provided on a story served by an accessible route.
6. In air traffic control towers, an accessible route shall not be required to serve the cab and *the equipment areas on the floor immediately below the cab.*

**7. Reserved.**

**11B-206.2.3.1 Stairs and escalators in existing buildings.** In alterations and additions, where an escalator or stair is provided where none existed previously and major structural modifications are necessary for the installation, an accessible route shall be provided between the levels served by the escalator or stair unless exempted by *Section 11B-206.2.3 Exceptions 1 through 7*.

**11B-206.2.3.2 Distance to elevators.** *In new construction of buildings where elevators are required by Section 11B-206.2.3, and which exceed 10,000 square feet (929 m<sup>2</sup>) on any floor, an accessible means of vertical access via ramp, elevator or lift shall be provided within 200 feet (60,960 mm) of travel of each stair and each escalator. In existing buildings that exceed 10,000 square feet (929 m<sup>2</sup>) on any floor and in which elevators are required by Section 11B-206.2.3, whenever a*

*newly constructed means of vertical access is provided via stairs or an escalator, an accessible means of vertical access via ramp, elevator or lift shall be provided within 200 feet (60,960 mm) of travel of each new stair or escalator.*

**11B-206.2.4 Spaces and elements.** At least one accessible route shall connect accessible building or facility entrances with all accessible spaces and elements within the building or facility, *including mezzanines*, which are otherwise connected by a circulation path unless exempted by *Section 11B-206.2.3 Exceptions 1 through 7*.

**Exceptions:**

**1. Reserved.**

2. In assembly areas with fixed seating required to comply with *Section 11B-221*, an accessible route shall not be required to serve fixed seating where wheelchair spaces required to be on an accessible route are not provided.

**3. Reserved.**

**11B-206.2.5. Restaurants, cafeterias, banquet facilities and bars.** In *restaurants, cafeterias, banquet facilities, bars, and similar facilities*, an accessible route shall be provided to all *functional* areas, including raised or sunken areas, and outdoor areas.

**Exceptions:**

1. In *alterations of buildings or facilities* not required to provide an accessible route between stories, an accessible route shall not be required to a mezzanine dining area where the mezzanine contains less than 25 percent of the total combined area for seating and dining and where the same decor and services are provided in the accessible area.
2. **Reserved.**
3. In sports facilities, tiered dining areas providing seating required to comply with *Section 11B-221* shall be required to have accessible routes serving at least 25 percent of the dining area provided that accessible routes serve seating complying with *Section 11B-221* and each tier is provided with the same services.

**11B-206.2.6 Performance areas.** Where a circulation path directly connects a performance area to an assembly seating area, an accessible route shall directly connect the assembly seating area with the performance area. An accessible route shall be provided from performance areas to ancillary areas or facilities used by performers unless exempted by *Section 11B-206.2.3 Exceptions 1 through 7*.

**11B-206.2.7 Press boxes.** Press boxes in assembly areas shall be on an accessible route.

**Exceptions:**

1. An accessible route shall not be required to press boxes in bleachers that have points of entry at only one level provided that the aggregate area of all press boxes is 500 square feet (46 m<sup>2</sup>) maximum.

2. An accessible route shall not be required to free-standing press boxes that are elevated above grade 12 feet (3660 mm) minimum provided that the aggregate area of all press boxes is 500 square feet (46 m<sup>2</sup>) maximum.

**11B-206.2.8 Employee work areas.** Common use circulation paths within employee work areas shall comply with *Section 11B-402*.

**Exceptions:**

1. *Reserved.*
2. Common use circulation paths located within employee work areas that are an integral component of work area equipment shall not be required to comply with *Section 11B-402*.
3. Common use circulation paths located within exterior employee work areas that are fully exposed to the weather shall not be required to comply with *Section 11B-402*.

**11B-206.2.9 Amusement rides.** Amusement rides required to comply with *Section 11B-234* shall provide accessible routes in accordance with *Section 11B-206.2.9*. Accessible routes serving amusement rides shall comply with *Division 4* except as modified by *Section 11B-1002.2*.

**11B-206.2.9.1 Load and unload areas.** Load and unload areas shall be on an accessible route. Where load and unload areas have more than one loading or unloading position, at least one loading and unloading position shall be on an accessible route.

**11B-206.2.9.2 Wheelchair spaces, ride seats designed for transfer, and transfer devices.** When amusement rides are in the load and unload position, wheelchair spaces complying with *Section 11B-1002.4*, amusement ride seats designed for transfer complying with *Section 11B-1002.5*, and transfer devices complying with *Section 11B-1002.6* shall be on an accessible route.

**11B-206.2.10 Recreational boating facilities.** Boat slips required to comply with *Section 11B-235.2* and boarding piers at boat launch ramps required to comply with *Section 11B-235.3* shall be on an accessible route. Accessible routes serving recreational boating facilities shall comply with *Division 4*, except as modified by *Section 11B-1003.2*.

**11B-206.2.11 Bowling lanes.** Where bowling lanes are provided, at least 5 percent, but no fewer than one of each type of bowling lane, shall be on an accessible route.

**11B-206.2.12 Court sports.** In court sports, at least one accessible route shall directly connect both sides of the court.

**11B-206.2.13 Exercise machines and equipment.** Exercise machines and equipment required to comply with *11B-236* shall be on an accessible route.

**11B-206.2.14 Fishing piers and platforms.** Fishing piers and platforms shall be on an accessible route. Accessible

routes serving fishing piers and platforms shall comply with *Division 4* except as modified by *Section 11B-1005.1*.

**11B-206.2.15 Golf facilities.** At least one accessible route shall connect accessible elements and spaces within the boundary of the golf course. In addition, accessible routes serving golf car rental areas; bag drop areas; course weather shelters complying with *Section 11B-238.2.3*; course toilet rooms; and practice putting greens, practice teeing grounds, and teeing stations at driving ranges complying with *Section 11B-238.3* shall comply with *Division 4* except as modified by *Section 11B-1006.2*.

**Exception:** Golf car passages complying with *Section 11B-1006.3* shall be permitted to be used for all or part of accessible routes required by *Section 11B-206.2.15*.

**11B-206.2.16 Miniature golf facilities.** Holes required to comply with *Section 11B-239.2*, including the start of play, shall be on an accessible route. Accessible routes serving miniature golf facilities shall comply with *Division 4* except as modified by *Section 11B-1007.2*.

**11B-206.2.17 Play areas.** Play areas shall provide accessible routes in accordance with *Section 11B-206.2.17*. Accessible routes serving play areas shall comply with *Division 4* except as modified by *Section 11B-1008.2*.

**11B-206.2.17.1 Ground level and elevated play components.** At least one accessible route shall be provided within the play area. The accessible route shall connect ground level play components required to comply with *Section 11B-240.2.1* and elevated play components required to comply with *Section 11B-240.2.2*, including entry and exit points of the play components.

**11B-206.2.17.2 Soft contained play structures.** Where three or fewer entry points are provided for soft contained play structures, at least one entry point shall be on an accessible route. Where four or more entry points are provided for soft contained play structures, at least two entry points shall be on an accessible route.

**11B-206.2.18 Area of sport activity.** An accessible route shall be provided to the boundary of each area of sport activity.

**11B-206.3 Location.** Accessible routes shall coincide with or be located in the same area as general circulation paths. Where circulation paths are interior, required accessible routes shall also be interior. An accessible route shall not pass through kitchens, storage rooms, restrooms, closets or other spaces used for similar purposes, except as permitted by *Chapter 10*.

**11B-206.4 Entrances.** Entrances shall be provided in accordance with *Section 11B-206.4*. Entrance doors, doorways, and gates shall comply with *Section 11B-404* and shall be on an accessible route complying with *Section 11B-402*.

**Exceptions:**

1. *Reserved.*
2. *Reserved.*

**11B-206.4.1 Entrances and exterior ground floor exits.** All entrances and exterior ground-floor exits to buildings and facilities shall comply with Section 11B-404.

**Exceptions:**

1. Exterior ground floor exits serving smoke-proof enclosures, stairwells, and exit doors serving stairs only shall not be required to comply with Section 11B-404.
2. Exits in excess of those required by Chapter 10, and which are more than 24 inches (610 mm) above grade shall not be required to comply with Section 11B-404. Such doors shall have warning signs complying with Section 11B-703.5, stating that they are not accessible.

**11B-206.4.2 Parking structure entrances.** Where direct access is provided for pedestrians from a parking structure to a building or facility entrance, each direct access to the building or facility entrance shall comply with Section 11B-404.

**11B-206.4.3 Entrances from tunnels or elevated walkways.** Where direct access is provided for pedestrians from a pedestrian tunnel or elevated walkway to a building or facility, all entrances to the building or facility from each tunnel or walkway shall comply with Section 11B-404.

**11B-206.4.4 Transportation facilities.** In addition to the requirements of Sections 11B-206.4.2, 11B-206.4.3, and 11B-206.4.5 through 11B-206.4.9, transportation facilities shall provide entrances in accordance with Section 11B-206.4.4.

**11B-206.4.4.1 Location.** In transportation facilities, where different entrances serve different transportation fixed routes or groups of fixed routes, entrances serving each fixed route or group of fixed routes shall comply with Section 11B-404.

**Exception:** Entrances to key stations and existing intercity rail stations retrofitted in accordance with 49 CFR 37.49 or 49 CFR 37.51 shall not be required to comply with Section 11B-206.4.4.1.

**11B-206.4.4.2 Direct connections.** Direct connections to other facilities shall provide an accessible route complying with Section 11B-404 from the point of connection to boarding platforms and all transportation system elements required to be accessible. Any elements provided to facilitate future direct connections shall be on an accessible route connecting boarding platforms and all transportation system elements required to be accessible.

**Exception:** In key stations and existing intercity rail stations, existing direct connections shall not be required to comply with Section 11B-404.

**11B-206.4.4.3 Key stations and intercity rail stations.** Key stations and existing intercity rail stations required by Subpart C of 49 CFR part 37 to be altered, shall have entrances complying with Section 11B-404.

**11B-206.4.5 Tenant spaces.** All entrances to each tenancy in a facility shall comply with Section 11B-404.

**Exception:** Self-service storage facilities not required to comply with Section 11B-225.3 shall not be required to be on an accessible route.

**11B-206.4.6 Residential dwelling unit primary entrance.** In residential dwelling units, at least one primary entrance shall comply with Section 11B-404. The primary entrance to a residential dwelling unit shall not be to a bedroom.

**11B-206.4.7 Restricted entrances.** Where restricted entrances are provided to a building or facility, all restricted entrances to the building or facility shall comply with Section 11B-404.

**11B-206.4.8 Service entrances.** If a service entrance is the only entrance to a building or to a tenancy in a facility, that entrance shall comply with Section 11B-404. In existing buildings and facilities, a service entrance shall not be the sole accessible entrance unless it is the only entrance to a building or facility.

**11B-206.4.9 Entrances for inmates or detainees.** Where entrances used only by inmates or detainees and security personnel are provided at judicial facilities, detention facilities, or correctional facilities, at least one such entrance shall comply with Section 11B-404.

**11B-206.4.10 Medical care and long-term care facilities.** Weather protection by a canopy or roof overhang shall be provided at a minimum of one accessible entrance to licensed medical care and licensed long-term care facilities where the period of stay may exceed twenty-four hours. The area of weather protection shall include the passenger loading zone complying with Section 11B-209.3 and the accessible route from the passenger loading zone to the accessible entrance it serves.

**11B-206.5 Doors, doorways, and gates.** Doors, doorways and gates providing user passage shall be provided in accordance with Section 11B-206.5.

**11B-206.5.1 Entrances.** Each entrance to a building or facility required to comply with Section 11B-206.4 shall comply with Section 11B-404.

**11B-206.5.2 Rooms and spaces.** Within a building or facility, every door, doorway or gate serving rooms and spaces complying with this chapter shall comply with Section 11B-404.

**11B-206.5.3 Transient lodging facilities.** In transient lodging facilities, entrances, doors, and doorways providing user passage into and within guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall comply with Section 11B-404.2.3.

**Exception:** Shower and sauna doors in guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall not be required to comply with Section 11B-404.2.3.

**11B-206.5.4 Residential dwelling units.** In residential dwelling units required to provide mobility features complying with Sections 11B-809.2 through 11B-809.4, all

doors and doorways providing user passage shall comply with *Section 11B-404*.

**11B-206.6 Elevators.** Elevators provided for passengers shall comply with *Section 11B-407*. Where multiple elevators are provided, each elevator shall comply with *Section 11B-407*.

**Exceptions:**

1. In a building or facility permitted to use the exceptions to *Section 11B-206.2.3* or permitted by *Section 11B-206.7* to use a platform lift, elevators complying with *Section 11B-408* shall be permitted.
2. Elevators complying with *Section 11B-408* or *11B-409* shall be permitted in multi-story residential dwelling units. *Elevators provided as a means of access within a private residence shall be installed so that they are not accessible to the general public or to other occupants of the building.*

**11B-206.6.1 Existing elevators.** Where elements of existing elevators are altered, the same element shall also be altered in all elevators that are programmed to respond to the same hall call control as the altered elevator and shall comply with the requirements of *Section 11B-407* for the altered element.

**11B-206.7 Platform lifts.** Platform lifts shall comply with *Section 11B-410*. Platform lifts shall be permitted as a component of an accessible route in new construction in accordance with *Section 11B-206.7*. Platform lifts shall be permitted as a component of an accessible route in an existing building or facility.

**11B-206.7.1 Performance areas and speakers' platforms.** Platform lifts shall be permitted to provide accessible routes to performance areas and speakers' platforms.

**11B-206.7.2 Wheelchair spaces.** Platform lifts shall be permitted to provide an accessible route to comply with the wheelchair space dispersion and line-of-sight requirements of *Sections 11B-221* and *11B-802*.

**11B-206.7.3 Incidental spaces.** Platform lifts shall be permitted to provide an accessible route to incidental spaces which are not public use spaces and which are occupied by five persons maximum.

**11B-206.7.4 Judicial spaces.** Platform lifts shall be permitted to provide an accessible route to: jury boxes and witness stands; raised courtroom stations including, judges' benches, clerks' stations, bailiffs' stations, deputy clerks' stations, and court reporters' stations; and to depressed areas such as the well of a court.

**11B-206.7.5 Existing site constraints.** Platform lifts shall be permitted where existing exterior site constraints make use of a ramp or elevator infeasible.

**11B-206.7.6 Guest rooms and residential dwelling units.** Platform lifts shall be permitted to connect levels within transient lodging guest rooms required to provide mobility features complying with *Section 11B-806.2* or residential dwelling units required to provide mobility features complying with *Sections 11B-809.2* through *11B-*

*809.4* and adaptable features complying with *Chapter 11A, Division IV*.

**11B-206.7.7 Amusement rides.** Platform lifts shall be permitted to provide accessible routes to load and unload areas serving amusement rides.

**11B-206.7.8 Play areas.** Platform lifts shall be permitted to provide accessible routes to play components or soft contained play structures.

**11B-206.7.9 Team or player seating.** Platform lifts shall be permitted to provide accessible routes to team or player seating areas serving areas of sport activity.

**11B-206.7.10 Recreational boating facilities and fishing piers and platforms.** Platform lifts shall be permitted to be used instead of gangways that are part of accessible routes serving recreational boating facilities and fishing piers and platforms.

**11B-206.8 Security barriers.** Security barriers, including but not limited to, security bollards and security check points, shall not obstruct a required accessible route or accessible means of egress.

**Exception:** Where security barriers incorporate elements that cannot comply with these requirements such as certain metal detectors, fluoroscopes, or other similar devices, the accessible route shall be permitted to be located adjacent to security screening devices. The accessible route shall permit persons with disabilities passing around security barriers to maintain visual contact with their personal items to the same extent provided others passing through the security barrier.

**11B-207 Accessible means of egress**

**11B-207.1 General.** Means of egress shall comply with *Chapter 10, Section 1007*.

**Exceptions:**

1. Where means of egress are permitted by local building or life safety codes to share a common path of egress travel, accessible means of egress shall be permitted to share a common path of egress travel.
2. Areas of refuge shall not be required in detention and correctional facilities.

**11B-207.2 Platform lifts.** Standby power shall be provided for platform lifts permitted by *Chapter 10, Section 1007.5* to serve as a part of an accessible means of egress. *To ensure continued operation in case of primary power loss, platform lifts shall be provided with standby power or with self-rechargeable battery power that provides sufficient power to operate all platform lift functions for a minimum of five upward and downward trips.*

**11B-208 Parking spaces**

**11B-208.1 General.** Where parking spaces are provided, parking spaces shall be provided in accordance with *Section 11B-208*.

**Exception:** Parking spaces used exclusively for buses, trucks, other delivery vehicles, or vehicular impound shall not be required to comply with *Section 11B-208* provided

TABLE 11B-208.2  
PARKING SPACES

TOTAL NUMBER OF PARKING SPACES PROVIDED IN PARKING FACILITY	MINIMUM NUMBER OF REQUIRED ACCESSIBLE PARKING SPACES
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000

that lots accessed by the public are provided with a passenger loading zone complying with *Section 11B-503*.

**11B-208.2 Minimum number.** Parking spaces complying with *Section 11B-502* shall be provided in accordance with Table 11B-208.2 except as required by *Sections 11B-208.2.1*, *11B-208.2.2*, and *11B-208.2.3*. Where more than one parking facility is provided on a site, the number of accessible spaces provided on the site shall be calculated according to the number of spaces required for each parking facility.

**11B-208.2.1 Hospital outpatient facilities.** Ten percent of patient and visitor parking spaces provided to serve hospital outpatient facilities, and free-standing buildings providing outpatient clinical services of a hospital, shall comply with *Section 11B-502*.

**11B-208.2.2 Rehabilitation facilities and outpatient physical therapy facilities.** Twenty percent of patient and visitor parking spaces provided to serve rehabilitation facilities specializing in treating conditions that affect mobility and outpatient physical therapy facilities shall comply with *Section 11B-502*.

**11B-208.2.3 Residential facilities.** Parking spaces provided to serve residential facilities shall comply with *Section 11B-208.2.3*.

**11B-208.2.3.1 Parking for residents.** Where at least one parking space is provided for each residential dwelling unit, at least one parking space complying with *Section 11B-502* shall be provided for each residential dwelling unit required to provide mobility features complying with *Sections 11B-809.2* through *11B-809.4*.

**11B-208.2.3.2 Additional parking spaces for residents.** Where the total number of parking spaces provided for each residential dwelling unit exceeds one parking space per residential dwelling unit, 2 percent, but no fewer than one space, of all the parking spaces not covered by *Section 11B-208.2.3.1* shall comply with *Section 11B-502*.

**11B-208.2.3.3 Parking for guests, employees, and other non-residents.** Where parking spaces are provided for persons other than residents, parking shall be provided in accordance with Table 11B-208.2.

**11B-208.2.3.4 Requests for accessible parking spaces.** When assigned parking is provided, designated accessible parking for the adaptable residential dwelling units shall be provided on requests of residents with disabilities on the same terms and with the full range of choices (e.g., off-street parking, carport or garage) that are available to other residents.

**11B-208.2.4 Van parking spaces.** For every six or fraction of six parking spaces required by *Section 11B-208.2* to comply with *Section 11B-502*, at least one shall be a van parking space complying with *Section 11B-502*.

**11B-208.3 Location.** Parking facilities shall comply with *Section 11B-208.3*.

**11B-208.3.1 General.** Parking spaces complying with *Section 11B-502* that serve a particular building or facility shall be located on the shortest accessible route from parking to an entrance complying with *Section 11B-206.4*. Where parking serves more than one accessible entrance, parking spaces complying with *Section 11B-502* shall be dispersed and located on the shortest accessible route to the accessible entrances. In parking facilities that do not serve a particular building or facility, parking spaces complying with *Section 11B-502* shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility.

**Exceptions:**

1. All van parking spaces shall be permitted to be grouped on one level within a multi-story parking facility.
2. Parking spaces shall be permitted to be located in different parking facilities if substantially equivalent or greater accessibility is provided in terms of distance from an accessible entrance or entrances, parking fee, and user convenience.



**11B-208.3.2 Residential facilities.** In residential facilities containing residential dwelling units required to provide mobility features complying with *Sections 11B-809.2 through 11B-809.4*, and *adaptable features complying with Chapter 11A, Division IV*, parking spaces provided in accordance with *Section 11B-208.2.3.1* shall be located on the shortest accessible route to the residential dwelling unit entrance they serve. Spaces provided in accordance with *Section 11B-208.2.3.2* shall be dispersed throughout all types of parking provided for the residential dwelling units.

**Exception:** Parking spaces provided in accordance with *Section 11B-208.2.3.2* shall not be required to be dispersed throughout all types of parking if substantially equivalent or greater accessibility is provided in terms of distance from an accessible entrance, parking fee, and user convenience.

**11B-208.3.3 Private garages accessory to residential dwelling units.** Private garages accessory to residential dwelling units shall comply with *Section 11B-208.3*. Private garages include individual garages and multiple individual garages grouped together.

**11B-208.3.3.1 Detached private garages accessory to residential dwelling units shall be accessible as required by *Section 11B-208.3*.**

**11B-208.3.3.2 Attached private garages directly serving a single residential dwelling unit shall provide at least one of the following options:**

1. A door leading directly from the residential dwelling unit which immediately enters the garage.
2. An accessible route from the residential dwelling unit to an exterior door entering the garage.
3. An accessible route from the residential dwelling unit's primary entry door to the vehicular entrance at the garage.

## **11B-209 Passenger loading zones and bus stops**

**11B-209.1 General.** Passenger loading zones shall be provided in accordance with *Section 11B-209*.

**11B-209.2 Type.** Where provided, passenger loading zones shall comply with *Section 11B-209.2*.

**11B-209.2.1 Passenger loading zones.** Passenger loading zones, except those required to comply with *Sections 11B-209.2.2 and 11B-209.2.3*, shall provide at least one passenger loading zone complying with *Section 11B-503* in every continuous 100 linear feet (30480 mm) of loading zone space, or fraction thereof.

**11B-209.2.2 Bus loading zones.** In bus loading zones restricted to use by designated or specified public transportation vehicles, each bus bay, bus stop, or other area designated for lift or ramp deployment shall comply with *Section 11B-810.2*.

**11B-209.2.3 On-street bus stops.** On-street bus stops shall comply with *Section 11B-810.2* to the maximum extent practicable.

**11B-209.3 Medical care and long-term care facilities.** At least one passenger loading zone complying with *Section 11B-503* shall be provided at an accessible entrance to licensed medical care and licensed long-term care facilities where the period of stay may exceed twenty-four hours.

**11B-209.4 Valet parking.** Parking facilities that provide valet parking services shall provide at least one passenger loading zone complying with *Section 11B-503*. The parking requirements of *Section 11B-208.1* apply to facilities with valet parking.

**11B-209.5 Mechanical access parking garages.** Mechanical access parking garages shall provide at least one passenger loading zone complying with *Section 11B-503* at vehicle drop-off and vehicle pick-up areas.

## **11B-210 Stairways**

**11B-210.1 General.** Interior and exterior stairs shall comply with *Section 11B-504*.

### **Exceptions:**

1. In detention and correctional facilities, stairs that are not located in public use areas shall not be required to comply with *Section 11B-504*.
2. In alterations, stairs between levels that are connected by an accessible route shall not be required to comply with *Section 11B-504*, except that *striping complying with Section 11B-504.4.1* and handrails complying with *Section 11B-505* shall be provided when the stairs are altered.
3. In assembly areas, aisle stairs shall not be required to comply with *Section 11B-504* except that *striping complying with Section 11B-504.4.1* shall be provided.
4. Stairs that connect play components shall not be required to comply with *Section 11B-504* except that *striping complying with Section 11B-504.4.1* shall be provided.

## **11B-211 Drinking fountains**

**11B-211.1 General.** Where drinking fountains are provided on an exterior site, on a floor, or within a secured area they shall be provided in accordance with *Section 11B-211*.

**Exception:** In detention or correctional facilities, drinking fountains only serving holding or housing cells not required to comply with *Section 11B-232* shall not be required to comply with *Section 11B-211*.

**11B-211.2 Minimum number.** No fewer than two drinking fountains shall be provided. One drinking fountain shall comply with *Sections 11B-602.1 through 11B-602.6* and one drinking fountain shall comply with *Section 11B-602.7*.

**Exception:** Where a single drinking fountain complies with *Sections 11B-602.1 through 11B-602.6* and *11B-602.7*, it shall be permitted to be substituted for two separate drinking fountains.

**11B-211.3 More than minimum number.** Where more than the minimum number of drinking fountains specified in *Section 11B-211.2* are provided, 50 percent of the total number of drinking fountains provided shall comply with *Sections*

11B-602.1 through 11B-602.6, and 50 percent of the total number of drinking fountains provided shall comply with Section 11B-602.7.

**Exception:** Where 50 percent of the drinking fountains yields a fraction, 50 percent shall be permitted to be rounded up or down provided that the total number of drinking fountains complying with Section 11B-211 equals 100 percent of drinking fountains.

#### **11B-212 Kitchens, kitchenettes, wet bars and sinks**

**11B-212.1 General.** Where provided, kitchens, kitchenettes, wet bars and sinks shall comply with Section 11B-212.

**11B-212.2 Kitchens, kitchenettes, and wet bars.** Kitchens, kitchenettes and wet bars shall comply with Section 11B-804.

**11B-212.3 Sinks.** Where sinks are provided, at least 5 percent, but no fewer than one, of each type provided in each accessible room or space shall comply with Section 11B-606.

##### **Exceptions:**

1. Mop, service or scullery sinks shall not be required to comply with Section 11B-212.3.
2. Scrub sinks, as defined in California Plumbing Code Section 221.0, shall not be required to comply with Section 11B-606.

#### **11B-213 Toilet facilities and bathing facilities**

**11B-213.1 General.** Where toilet facilities and bathing facilities are provided, they shall comply with Section 11B-213. Where toilet facilities and bathing facilities are provided in facilities permitted by Section 11B-206.2.3 *Exception 1* not to connect stories by an accessible route, toilet facilities and bathing facilities shall be provided on a story connected by an accessible route to an accessible entrance.

**11B-213.1.1 Toilet facilities for designated user groups.** Where separate toilet facilities are provided for the exclusive use of separate user groups, the toilet facilities serving each user group shall comply with Section 11B-213.

**11B-213.2 Toilet rooms and bathing rooms.** Where toilet rooms are provided, each toilet room shall comply with Section 11B-603. Where bathing rooms are provided, each bathing room shall comply with Section 11B-603.

##### **Exceptions:**

1. In alterations where it is technically infeasible to comply with Section 11B-603, altering existing toilet or bathing rooms shall not be required where a single unisex toilet room or bathing room complying with Section 11B-213.2.1 is provided and located in the same area and on the same floor as existing inaccessible toilet or bathing rooms.
2. *Reserved.*
3. Where multiple single user portable toilet or bathing units are clustered at a single location 5 percent, but no fewer than one, of the toilet units and bathing units at each cluster shall comply with Section 11B-603. Portable toilet units and bathing units complying with Section 11B-603 shall be identified by the

International Symbol of Accessibility complying with Section 11B-703.7.2.1.

4. Where multiple single user toilet rooms are clustered at a single location, 50 percent, but no fewer than one, of the single user toilet rooms for each use at each cluster shall comply with Section 11B-603.
5. Where toilet and bathing rooms are provided in guest rooms that are not required to provide mobility features complying with Section 11B-806.2, toilet and bathing fixtures shall only be required to comply with Section 11B-603.6.

**11B-213.2.1 Unisex (single-use or family) toilet and unisex bathing rooms.** Unisex toilet rooms shall contain not more than one lavatory, and not more than two water closets without urinals or one water closet and one urinal. Unisex bathing rooms shall contain one shower or one shower and one bathtub, one lavatory, and one water closet. Doors to unisex toilet rooms and unisex bathing rooms shall have privacy latches.

**11B-213.2.2 Unisex (Patient) toilet rooms in medical care and long-term care facilities.** Common-use unisex toilet rooms for exclusive patient use not located within patient bedrooms shall contain a lavatory and one water closet.

**11B-213.2.3 Unisex (Patient) bathing rooms in medical care and long-term care facilities.** Common-use unisex bathing rooms for exclusive patient use not located within patient bedrooms shall contain one shower or one bathtub, one lavatory, and one water closet.

**11B-213.3 Plumbing fixtures and accessories.** Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with Section 11B-213.2 shall comply with Section 11B-213.3.

**11B-213.3.1 Toilet compartments.** Where toilet compartments are provided, at least one toilet compartment shall comply with Section 11B-604.8.1. In addition to the compartment required to comply with Section 11B-604.8.1, at least one compartment shall comply with Section 11B-604.8.2 where six or more toilet compartments are provided, or where the combination of urinals and water closets totals six or more fixtures.

**11B-213.3.2 Water closets.** Where water closets are provided, at least one shall comply with Section 11B-604.

**11B-213.3.3 Urinals.** Where one or more urinals are provided, at least one shall comply with Section 11B-605.

**11B-213.3.4 Lavatories.** Where lavatories are provided, at least five percent but no fewer than one shall comply with Section 11B-606 and shall not be located in a toilet compartment.

**11B-213.3.5 Mirrors.** Where mirrors are provided, at least one shall comply with Section 11B-603.3.

**11B-213.3.6 Bathing facilities.** Where bathtubs or showers are provided, at least one bathtub complying with Section 11B-607 or at least one shower complying with Section 11B-608 shall be provided. Where two or more accessible showers are provided within the same func-

tional area, at least one shower shall be opposite hand from the other or others (that is, one left-hand controls versus right-hand controls).

**11B-213.3.7 Coat hooks and shelves.** Where coat hooks or shelves are provided in toilet rooms without toilet compartments, at least one of each type shall comply with *Section 11B-603.4*. Where coat hooks or shelves are provided in toilet compartments, at least one of each type complying with *Section 11B-604.8.3* shall be provided in toilet compartments required to comply with *Section 11B-213.3.1*. Where coat hooks or shelves are provided in bathing facilities, at least one of each type complying with *Section 11B-603.4* shall serve fixtures required to comply with *Section 11B-213.3.6*.

#### **11B-214 Washing machines and clothes dryers**

**11B-214.1 General.** Where provided, washing machines and clothes dryers shall comply with *Section 11B-214*.

**11B-214.2 Washing machines.** Where three or fewer washing machines are provided, at least one shall comply with *Section 11B-611*. Where more than three washing machines are provided, at least two shall comply with *Section 11B-611*.

**11B-214.3 Clothes dryers.** Where three or fewer clothes dryers are provided, at least one shall comply with *Section 11B-611*. Where more than three clothes dryers are provided, at least two shall comply with *Section 11B-611*.

#### **11B-215 Fire alarm systems**

**11B-215.1 General.** Where fire alarm systems provide audible alarm coverage, alarms shall comply with *Section 11B-215*.

**Exception:** In existing facilities, visible alarms shall not be required except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.

**11B-215.2 Public and common use areas.** Alarms in public use areas and common use areas shall comply with *Chapter 9, Section 907.5.2.3.1*.

**11B-215.3 Employee work areas.** Where employee work areas have audible alarm coverage, the wiring system shall be designed so that visible alarms complying with *Chapter 9, Section 907.5.2.3.2* can be integrated into the alarm system.

**11B-215.4 Transient lodging.** Guest rooms required to comply with *Section 11B-224.4* shall provide alarms complying with *Chapter 9, Section 907.5.2.3.3*.

**11B-215.5 Residential facilities.** Where provided in residential dwelling units required to comply with *Section 11B-809.5*, alarms shall comply with *Chapter 9, Section 907.5.2.3.4*.

#### **11B-216 Signs**

**11B-216.1 General.** New or altered signs shall be provided in accordance with *Section 11B-216* and shall comply with

*Section 11B-703*. The addition of or replacement of signs shall not trigger any additional path of travel requirements.

#### **Exceptions:**

1. Building directories, menus, seat and row designations in assembly areas, occupant names, building addresses, and company names and logos shall not be required to comply with *Section 11B-216*.
2. In parking facilities, signs *provided solely for the operation of vehicles* shall not be required to comply with *Sections 11B-216.2, 11B-216.3, and 11B-216.6* through *11B-216.12*.
3. Temporary, 7 days or less, signs shall not be required to comply with *Section 11B-216*.
4. In detention and correctional facilities, signs not located in public use areas shall not be required to comply with *Section 11B-216*.

**11B-216.2 Designations.** Interior and exterior signs identifying permanent rooms and spaces shall comply with *Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5*. Where pictograms are provided as designations of permanent rooms and spaces, the pictograms shall comply with *Section 11B-703.6* and shall have text descriptors complying with *Sections 11B-703.2 and 11B-703.5*.

**Exception:** Exterior signs that are not located at the door to the space they serve shall not be required to comply with *Section 11B-703.2*.

**11B-216.3 Directional and informational signs.** Signs that provide direction to or information about interior and exterior spaces and facilities of the site shall comply with *Section 11B-703.5*.

**11B-216.4 Means of egress.** Signs for means of egress shall comply with *Section 11B-216.4*.

**11B-216.4.1 Exit doors.** Signs required by *Chapter 10, Section 1011.4* at doors to exit passageways, exit discharge, and exit stairways shall comply with *Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5*.

**11B-216.4.2 Areas of refuge and exterior areas for assisted rescue.** Signs required by *Chapter 10, Section 1007.11* to provide instructions in areas of refuge shall comply with *Section 11B-703.5*. Signs required by *Chapter 10, Section 1007.9* at doors to areas of refuge and exterior areas for assisted rescue shall comply with *Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5* and include an International Symbol of Accessibility complying with *Section 11B-703.7.2.1*.

**11B-216.4.3 Directional signs.** Signs required by *Chapter 10, Section 1007.10* to provide directions to accessible means of egress shall comply with *Section 11B-703.5*.

**11B-216.4.4 Delayed egress locks.** Signs required by *Chapter 10, Section 1008.1.9.7, Item 5.1* at doors with delayed egress locks shall comply with *Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5*.

**11B-216.5 Parking.** Parking spaces complying with *Section 11B-502* shall be identified by signs complying with *Section 11B-502.6*.

**Exceptions:**

1. *Reserved.*
2. In residential facilities, where parking spaces are assigned to specific residential dwelling units, identification of accessible parking spaces shall not be required.

**11B-216.6 Entrances.** *In existing buildings and facilities where not all entrances comply with Section 11B-404, entrances complying with Section 11B-404 shall be identified by the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Directional signs complying with Section 11B-703.5 that indicate the location of the nearest entrance complying with Section 11B-404 shall be provided at entrances that do not comply with Section 11B-404. Directional signs complying with Section 11B-703.5, including the International Symbol of Accessibility complying with Section 11B-703.7.2.1, indicating the accessible route to the nearest accessible entrance shall be provided at junctions when the accessible route diverges from the regular circulation path.*

**Exceptions:**

1. *An International Symbol of Accessibility is not required at entrances to individual rooms, suites, offices, sales or rental establishments, or other such spaces when all entrances to the building or facility are accessible and persons entering the building or facility have passed through one or more entrances with signage complying with this section.*
2. *An International Symbol of Accessibility is not required at entrances to machinery spaces frequented only by service personnel for maintenance, repair, or occasional monitoring of equipment; for example, elevator pits or elevator penthouses; mechanical, electrical or communications equipment rooms; piping or equipment catwalks; electric substations and transformer vaults; and highway and tunnel utility facilities.*

**11B-216.7 Elevators.** Where existing elevators do not comply with *Section 11B-407*, elevators complying with *Section 11B-407* shall be clearly identified with the International Symbol of Accessibility complying with *Section 11B-703.7.2.1*. *Existing buildings that have been remodeled to provide specific elevators for public use that comply with these building standards shall have the location of and the directions to these elevators posted in the building lobby on a sign complying with Section 11B-703.5, including the International Symbol of Accessibility complying with Section 11B-703.7.2.1.*

**11B-216.8 Toilet rooms and bathing rooms.** *Doorways leading to toilet rooms and bathing rooms complying with Section 11B-603 shall be identified by a geometric symbol complying with Section 11B-703.7.2.6. Where existing toilet rooms or bathing rooms do not comply with Section 11B-603, directional signs indicating the location of the nearest toilet*

*room or bathing room complying with Section 11B-603 within the facility shall be provided. Signs shall comply with Section 11B-703.5 and shall include the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Where existing toilet rooms or bathing rooms do not comply with Section 11B-603, the toilet rooms or bathing rooms complying with Section 11B-603 shall be identified by the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Where clustered single user toilet rooms or bathing facilities are permitted to use exceptions to Section 11B-213.2, toilet rooms or bathing facilities complying with Section 11B-603 shall be identified by the International Symbol of Accessibility complying with Section 11B-703.7.2.1 unless all toilet rooms and bathing facilities comply with Section 11B-603. Existing buildings that have been remodeled to provide specific toilet rooms or bathing rooms for public use that comply with these building standards shall have the location of and the directions to these rooms posted in or near the building lobby or entrance on a sign complying with Section 11B-703.5, including the International Symbol of Accessibility complying with Section 11B-703.7.2.1.*

**11B-216.9 TTYs.** Identification and directional signs for public TTYs shall be provided in accordance with *Section 11B-216.9*.

**11B-216.9.1 Identification signs.** Public TTYs shall be identified by the International Symbol of TTY complying with *Section 11B-703.7.2.2*.

**11B-216.9.2 Directional signs.** Directional signs indicating the location of the nearest public TTY shall be provided at all banks of public pay telephones not containing a public TTY. In addition, where signs provide direction to public pay telephones, they shall also provide direction to public TTYs. *If a facility has no banks of telephones, the directional signage shall be provided at the entrance or in a building directory.* Directional signs shall comply with *Section 11B-703.5* and shall include the International Symbol of TTY complying with *Section 11B-703.7.2.2*.

**11B-216.10 Assistive listening systems.** Each assembly area required by *Section 11B-219* to provide assistive listening systems shall provide signs informing patrons of the availability of the assistive listening system. *The sign shall include wording that states "Assistive-Listening System Available" and shall be posted in a prominent place at or near the assembly area entrance.* Assistive listening signs shall comply with *Section 11B-703.5* and shall include the International Symbol of Access for Hearing Loss complying with *Section 11B-703.7.2.4*.

**Exception:** Where ticket offices or windows are provided, signs shall not be required at each assembly area provided that signs are displayed at each ticket office or window informing patrons of the availability of assistive listening systems.

**11B-216.11 Check-out aisles.** Where more than one check-out aisle is provided, check-out aisles complying with *Section 11B-904.3* shall be identified by a sign complying with *Section 11B-904.3.4*. Where check-out aisles are identified by numbers, letters, or functions, signs identifying check-out

aisles complying with *Section 11B-904.3* shall be located in the same location as the check-out aisle identification.

**Exception:** Where all check-out aisles comply with *Section 11B-904.3*, signs complying with *Section 11B-703.7.2.1* shall not be required.

**11B-216.12 Amusement rides.** Signs identifying the type of access provided on amusement rides shall be provided at entries to queues and waiting lines. In addition, where accessible unload areas also serve as accessible load areas, signs indicating the location of the accessible load and unload areas shall be provided at entries to queues and waiting lines. Signs shall comply with *Section 11B-703.5* and shall include the *International Symbol of Accessibility* complying with *Section 11B-703.7.2.1*.

#### **11B-216.13 Cleaner Air Symbol**

**11B-216.13.1 Use of Cleaner Air Symbol.** Use of the Cleaner Air Symbol is voluntary. Where publicly funded facilities or any facilities leased or rented by the State of California, not including concessionaires, comply with the conditions of use identified in *Section 11B-216.13.3*, a Cleaner Air Symbol complying with *Section 11B-703.7.2.5* is permitted to be posted in compliance with *Section 11B-216.3* to indicate rooms, facilities, and paths of travel that are accessible to and usable by people who are adversely impacted by airborne chemicals or particulates and/or the use of electrical fixtures and/or devices.

**11B-216.13.2 Removal of Cleaner Air Symbol.** If the path of travel, room and/or facility identified by the Cleaner Air Symbol should temporarily or permanently cease to meet the minimum conditions of use identified in *Section 11B-216.13.3*, the Cleaner Air Symbol shall be removed and shall not be replaced until the minimum conditions are again met.

**11B-216.13.3 Conditions of use.** The Cleaner Air Symbol shall be permitted for use to identify a path of travel, and a room or a facility when the following is met:

1. Floor or wall coverings, floor or wall covering adhesives, carpets, formaldehyde-emitting particle-board cabinetry, cupboards or doors have not been installed or replaced in the previous 12 months.
2. Incandescent lighting provided in lieu of fluorescent or halogen lighting, and electrical systems and equipment shall be operable by or on behalf of the occupant or user of the room, facility or path of travel.
3. Heating, ventilation, air conditioning and their controls shall be operable by or on behalf of the occupant or user.

4. To maintain “cleaner air” designation only nonirritating, nontoxic products will be used in cleaning, maintenance, disinfection, pest management or for any minimal touch-ups that are essential for occupancy of the area. Deodorizers or Fragrance Emission Devices and Systems (FEDS) shall not be used in the designated area. Pest control practices for cleaner air areas shall include the use of bait stations using boric acid, sticky traps and silicon caulk for sealing cracks and crevices. Areas shall be routinely monitored for pest problems. Additional nontoxic treatment methods, such as temperature extremes for termites, may be employed in the event of more urgent problems. These pest control practices shall not be used 48 hours prior to placement of the sign, and the facility shall be ventilated with outside air for a minimum of 24 hours following use or application.

5. Signage shall be posted requesting occupants or users not to smoke or wear perfumes, colognes or scented personal care products. Fragranced products shall not be used in the designated cleaner-air room, facility or path of travel.

6. A log shall be maintained on site, accessible to the public either in person or by telephone, e-mail, fax or other accessible means as requested. One or more individuals shall be designated to maintain the log. The log shall record any product or practice used in the cleaner air designated room, facility or path of travel, as well as scheduled activities, that may impact the cleaner air designation. The log shall also include the product label as well as the Material Safety Data Sheets (MSDS).

#### **11B-217 Telephones**

**11B-217.1 General.** Where coin-operated public pay telephones, coinless public pay telephones, public closed-circuit telephones, public courtesy phones, or other types of public telephones are provided, public telephones shall be provided in accordance with *Section 11B-217* for each type of public telephone provided. For purposes of this section, a bank of telephones shall be considered to be two or more adjacent telephones.

**11B-217.2 Wheelchair accessible telephones.** Where public telephones are provided, wheelchair accessible telephones complying with *Section 11B-704.2* shall be provided in accordance with *Table 11B-217.2*.

**Exception:** Drive-up only public telephones shall not be required to comply with *Section 11B-217.2*.

**TABLE 11B-217.2  
WHEELCHAIR ACCESSIBLE TELEPHONES**

NUMBER OF TELEPHONES PROVIDED ON A FLOOR, LEVEL, OR EXTERIOR SITE	MINIMUM NUMBER OF REQUIRED WHEELCHAIR ACCESSIBLE TELEPHONES
1 or more single units	At least 50 percent of telephone units, but not less than 1 per floor, level, and exterior site
1 bank	At least 50 percent of telephone units per bank, but not less than 1 per floor, level, and exterior site
2 or more banks	At least 50 percent of telephone units per bank, but not less than 1 per bank At least 1 telephone per floor shall meet the requirements for a forward reach telephone.

**11B-217.3 Volume controls.** All public telephones shall have volume controls complying with *Section 11B-704.3*.

**11B-217.4 TTYs.** TTYs complying with *Section 11B-704.4* shall be provided in accordance with *Section 11B-217.4*.

**11B-217.4.1 Bank requirement.** Where four or more public pay telephones are provided at a bank of telephones, at least one public TTY complying with *Section 11B-704.4* shall be provided at that bank.

**Exception: Reserved.**

**11B-217.4.2 Floor requirement.** TTYs in public buildings shall be provided in accordance with *Section 11B-217.4.2.1*. TTYs in private buildings shall be provided in accordance with *Section 11B-217.4.2.2*.

**11B-217.4.2.1 Public buildings.** Where at least one public pay telephone is provided on a floor of a public building, at least one public TTY shall be provided on that floor.

**11B-217.4.2.2 Private buildings.** Where four or more public pay telephones are provided on a floor of a private building, at least one public TTY shall be provided on that floor.

**11B-217.4.3 Building requirement.** TTYs in public buildings shall be provided in accordance with *Section 11B-217.4.3.1*. TTYs in private buildings shall be provided in accordance with *Section 11B-217.4.3.2*.

**11B-217.4.3.1 Public buildings.** Where at least one public pay telephone is provided in a public building, at least one public TTY shall be provided in the building. Where at least one public pay telephone is provided in a public use area of a public building, at least one public TTY shall be provided in the public building in a public use area.

**11B-217.4.3.2 Private buildings.** Where four or more public pay telephones are provided in a private building, at least one public TTY shall be provided in the building.

**Exception:** *In a stadium or arena, in a convention center, in a hotel with a convention center or in a covered mall, if an interior public pay telephone is provided at least one interior public text telephone shall be provided in the facility.*

**11B-217.4.4 Exterior site requirement.** Where four or more public pay telephones are provided on an exterior site, at least one public TTY shall be provided on the site.

**11B-217.4.5 Rest stops, emergency roadside stops, and service plazas.** Where at least one public pay telephone is provided at a public rest stop, emergency roadside stop, or service plaza, at least one public TTY shall be provided.

**11B-217.4.6 Hospitals.** Where at least one public pay telephone is provided serving a hospital emergency room, hospital recovery room, or hospital waiting room, at least one public TTY shall be provided at each location.

**11B-217.4.7 Transportation facilities.** In transportation facilities, in addition to the requirements of *Sections 11B-217.4.1 through 11B-217.4.4*, where at least one public

pay telephone serves a particular entrance to a bus or rail facility, at least one public TTY shall be provided to serve that entrance. In airports, in addition to the requirements of *Sections 11B-217.4.1 through 11B-217.4.4*, where four or more public pay telephones are located in a terminal outside the security areas, a concourse within the security areas, or a baggage claim area in a terminal, at least one public TTY shall be provided in each location.

**11B-217.4.8 Detention and correctional facilities.** In detention and correctional facilities, where at least one pay telephone is provided in a secured area used only by detainees or inmates and security personnel, at least one TTY shall be provided in at least one secured area.

**11B-217.5 Shelves for portable TTYs.** Where a bank of telephones in the interior of a building consists of three or more public pay telephones, at least one public pay telephone at the bank shall be provided with a shelf and an electrical outlet in accordance with *Section 11B-704.5*.

**Exceptions:**

1. Secured areas of detention and correctional facilities where shelves and outlets are prohibited for purposes of security or safety shall not be required to comply with *Section 11B-217.5*.
2. The shelf and electrical outlet shall not be required at a bank of telephones with a TTY.

## **11B-218 Transportation facilities**

**11B-218.1 General.** Transportation facilities shall comply with *Section 11B-218*.

**11B-218.2 New and altered fixed guideway stations.** New and altered stations in rapid rail, light rail, commuter rail, intercity rail, high speed rail, and other fixed guideway systems shall comply with *Sections 11B-810.5 through 11B-810.10*.

**11B-218.3 Key stations and existing intercity rail stations.** Key stations and existing intercity rail stations shall comply with *Sections 11B-810.5 through 11B-810.10*.

**11B-218.4 Bus shelters.** Where provided, bus shelters shall comply with *Section 11B-810.3*.

**11B-218.5 Other transportation facilities.** In other transportation facilities, public address systems shall comply with *Section 11B-810.7* and clocks shall comply with *Section 11B-810.8*.

## **11B-219 Assistive listening systems**

**11B-219.1 General.** Assistive listening systems shall be provided in accordance with *Section 11B-219* and shall comply with *Section 11B-706*.

**11B-219.2 Required systems.** *An assistive listening system shall be provided in assembly areas, including conference and meeting rooms.*

**Exception:** *This section does not apply to systems used exclusively for paging, background music, or a combination of these two uses.*

**11B-219.3 Receivers.** *The minimum number of receivers to be provided shall be equal to 4 percent of the total number of*



seats, but in no case less than two. Twenty-five percent minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with Section 11B-706.3.

**Exceptions:**

1. Where a building contains more than one assembly area and the assembly areas required to provide assistive listening systems are under one management, the total number of required receivers shall be permitted to be calculated according to the total number of seats in the assembly areas in the building provided that all receivers are usable with all systems.
2. Where all seats in an assembly area are served by an induction loop assistive listening system, the minimum number of receivers required by Section 11B-219.3 to be hearing-aid compatible shall not be required to be provided.

**11B-219.4 Location.** If the assistive-listening system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot (15240 mm) viewing distance of the stage or playing area and shall have a complete view of the stage or playing area.

**11B-219.5 Permanent and portable systems.** Permanently installed assistive-listening systems are required in areas if (1) they accommodate at least 50 persons or if they have audio-amplification systems, and (2) they have fixed seating. If portable assistive-listening systems are used for conference or meeting rooms, the system may serve more than one room. An adequate number of electrical outlets or other supplementary wiring necessary to support a portable assistive-listening system shall be provided.

**11B-220 Automatic teller machines, fare machines and point-of-sale devices.**

**11B-220.1 Automatic teller machines and fare machines.** Where automatic teller machines or self-service fare vending, collection, or adjustment machines are provided they shall comply with Section 11B-220.1. Where bins are provided for envelopes, waste paper, or other purposes, at least one of each type shall comply with Section 11B-811.

**11B-220.1.1 One automatic teller machine or fare machine.** Where one automatic teller machine or fare machine is provided at a location, it shall comply with Sections 11B-707.2 through 11B-707.8.

**11B-220.1.2 Two automatic teller machines or fare machines.** Where two automatic teller machines or fare machines are provided at a location, one shall comply with Sections 11B-707.2 through 11B-707.8 and one shall comply with Sections 11B-309, 11B-707.2, 11B-707.4, 11B-707.5, 11B-707.6, 11B-707.7.2 and 11B-707.8.

**11B-220.1.3 Three or more automatic teller machines or fare machines.** Where three or more automatic teller machines or fare machines are provided at a location, at least 50 percent shall comply with Sections 11B-707.2 through 11B-707.8 and the rest shall comply with Sections 11B-309, 11B-707.2, 11B-707.4, 11B-707.5, 11B-707.6, 11B-707.7.2 and 11B-707.8.

**11B-220.2 Point-of-sale devices.** Where point-of-sale devices are provided, all devices at each location shall comply with Sections 11B-309.4, 11B-707.3, and 11B-707.7.2. In addition, point-of-sale systems that include a video touch screen or any other non-tactile keypad shall comply with either Section 11B-707.9.1.1 or 11B-707.9.1.2. Where point-of-sale devices are provided at check stands and sales and service counters, they shall comply with Section 11B-707.9.1, and shall also comply with Sections 11B-707.2, 11B-707.3 and 11B-707.4.

**Exception:** Where a single point-of-sale device is installed for use with any type of motor fuel, it shall comply with Sections 11B-220.2 and 11B-309. Where more than one point-of-sale device is installed for use with a specific type of motor fuel, a minimum of two for that type shall comply with Sections 11B-220.2 and 11B-309. Types of motor fuel include, but are not limited to, gasoline, diesel, compressed natural gas, methanol, ethanol or electricity.

**11B-221 Assembly areas**

**11B-221.1 General.** Assembly areas shall provide wheelchair spaces, companion seats, and designated aisle seats and semi-ambulant seats complying with Sections 11B-221 and 11B-802. In addition, lawn seating shall comply with Section 11B-221.5.

**11B-221.2 Wheelchair spaces.** Wheelchair spaces complying with Section 11B-221.2 shall be provided in assembly areas with fixed seating.

**11B-221.2.1 Number and location.** Wheelchair spaces shall be provided complying with Section 11B-221.2.1.

**11B-221.2.1.1 General seating.** Wheelchair spaces complying with Section 11B-802.1 shall be provided in accordance with Table 11B-221.2.1.1.

**TABLE 11B-221.2.1.1  
NUMBER OF WHEELCHAIR SPACES IN ASSEMBLY AREAS**

NUMBER OF SEATS	MINIMUM NUMBER OF REQUIRED WHEELCHAIR SPACES
4 to 25	1
26 to 50	2
51 to 150	4
151 to 300	5
301 to 500	6
501 to 5000	6, plus 1 for each 100, or fraction thereof, between 501 through 5000
5001 and over	46, plus 1 for each 200, or fraction thereof, over 5000

**11B-221.2.1.2 Luxury boxes, club boxes, and suites in arenas, stadiums, and grandstands.** In each luxury box, club box, and suite within arenas, stadiums, and grandstands, wheelchair spaces complying with *Section 11B-802.1* shall be provided in accordance with Table 11B-221.2.1.1.

**11B-221.2.1.3 Other boxes.** In boxes other than those required to comply with *Section 11B-221.2.1.2*, the total number of wheelchair spaces required shall be determined in accordance with Table 11B-221.2.1.1. Wheelchair spaces shall be located in not less than 20 percent of all boxes provided. Wheelchair spaces shall comply with *Section 11B-802.1*.

**11B-221.2.1.4 Team or player seating.** At least one wheelchair space complying with *Section 11B-802.1* shall be provided in team or player seating areas serving areas of sport activity.

**Exception:** Wheelchair spaces shall not be required in team or player seating areas serving bowling lanes not required to comply with *Section 11B-206.2.11*.

**11B-221.2.1.5 Stadium-style movie theaters.** In stadium-style movie theaters, the total number of wheelchair spaces required shall be determined in accordance with Table 11B-221.2.1.1. The required wheelchair spaces shall be located on risers or cross-aisles in the stadium section that satisfy at least one of the following criteria:

1. Located within the rear 60 percent of the seats provided in the theater; or
2. Located within the area of the theater in which the vertical viewing angles (as measured to the top of the screen) are from the 40<sup>th</sup> to the 100<sup>th</sup> percentile of vertical viewing angles for all seats as ranked from the seats in the first row (1<sup>st</sup> percentile) to seats in the back row (100<sup>th</sup> percentile).

**11B-221.2.1.6 Specialty seating areas.** In assembly areas, wheelchair spaces shall be provided in each specialty seating area that provides spectators with distinct services or amenities that generally are not available to other spectators. The number of wheelchair spaces provided in specialty seating areas shall be included in, rather than be in addition to, the total number of wheelchair spaces required by Table 11B-221.2.1.1.

**Exception:** In existing buildings and facilities, if it is not readily achievable for wheelchair spaces to be placed in each specialty seating area, those services or amenities shall be provided to individuals with disabilities, and their companions, at other designated accessible locations at no additional cost.

**11B-221.2.2 Integration.** Wheelchair spaces shall be an integral part of the seating plan.

**11B-221.2.3 Lines of sight and dispersion.** Wheelchair spaces shall provide lines of sight complying with *Section 11B-802.2* and shall comply with *Section 11B-221.2.3*. In

providing lines of sight, wheelchair spaces shall be dispersed. Wheelchair spaces shall provide spectators with choices of seating locations and viewing angles that are substantially equivalent to, or better than, the choices of seating locations and viewing angles available to all other spectators. When the number of wheelchair spaces required by *Section 11B-221.2.1* has been met, further dispersion shall not be required. *In stadiums, arenas and grandstands, wheelchair spaces shall be dispersed to all levels that include seating served by an accessible route.*

**Exception:** Wheelchair spaces in team or player seating areas serving areas of sport activity shall not be required to comply with *Section 11B-221.2.3*.

**11B-221.2.3.1 Horizontal dispersion.** Wheelchair spaces shall be dispersed horizontally. *In assembly areas that have seating encircling, in whole or in part, a field of play or performance, wheelchair spaces shall be dispersed horizontally around the field of play or performance area.*

**Exceptions:**

1. Horizontal dispersion shall not be required in assembly areas with 300 or fewer seats if the companion seats required by *Section 11B-221.3* and wheelchair spaces are located within the 2<sup>nd</sup> or 3<sup>rd</sup> quartile of the total row length. Intermediate aisles shall be included in determining the total row length. If the row length in the 2<sup>nd</sup> and 3<sup>rd</sup> quartile of a row is insufficient to accommodate the required number of companion seats and wheelchair spaces, the additional companion seats and wheelchair spaces shall be permitted to be located in the 1<sup>st</sup> and 4<sup>th</sup> quartile of the row.
2. In row seating, two wheelchair spaces shall be permitted to be located side-by-side.

**11B-221.2.3.2 Vertical dispersion.** Wheelchair spaces shall be dispersed vertically at varying distances from the screen, performance area, or playing field. In addition, wheelchair spaces shall be located in each balcony or mezzanine that is located on an accessible route.

**Exceptions:**

1. Vertical dispersion shall not be required in assembly areas with 300 or fewer seats if the wheelchair spaces provide viewing angles that are equivalent to, or better than, the average viewing angle provided in the facility.
2. In bleachers, wheelchair spaces shall not be required to be provided in rows other than rows at points of entry to bleacher seating.

**11B-221.2.4 Temporary structures.** Wheelchair spaces shall not be located on, or be obstructed by, temporary platforms or other movable structures.

**Exception:** When an entire seating section is placed on temporary platforms or other movable structures in an area where fixed seating is not provided, in order to



*increase seating for an event, wheelchair spaces may be placed in that section.*

**11B-221.2.5 Removable chairs.** *When required wheelchair spaces are not occupied by persons eligible for those spaces, individual, removable seats may be placed in those spaces.*

**11B-221.3 Companion seats.** At least one companion seat complying with Section 11B-802.3 shall be provided for each wheelchair space required by Section 11B-221.2.1.

**11B-221.4 Designated aisle seats.** At least 5 percent of the total number of aisle seats provided shall comply with Section 11B-802.4 and shall be the aisle seats located closest to accessible routes.

**Exception:** Team or player seating areas serving areas of sport activity shall not be required to comply with Section 11B-221.4.

**11B-221.5 Lawn seating.** Lawn seating areas and exterior overflow seating areas, where fixed seats are not provided, shall connect to an accessible route.

**11B-221.6 Semi-ambulant seats.** *At least 1 percent of the total number of seats, and no fewer than two, shall be semi-ambulant seats complying with Section 11B-802.5.*

#### **11B-222 Dressing, fitting, and locker rooms**

**11B-222.1 General.** Where dressing rooms, fitting rooms, or locker rooms are provided, at least 5 percent, but no fewer than one, of each type of use in each cluster provided shall comply with Section 11B-803.

**Exception:** In alterations, where it is technically infeasible to provide rooms in accordance with Section 11B-222.1, one room for each sex on each level shall comply with Section 11B-803. Where only unisex rooms are provided, unisex rooms shall be permitted.

**11B-222.2 Coat hooks and shelves.** Where coat hooks or shelves are provided in dressing, fitting or locker rooms without individual compartments, at least one of each type shall comply with Section 11B-803.5. Where coat hooks or shelves are provided in individual compartments at least one of each type complying with Section 11B-803.5 shall be provided in individual compartments in dressing, fitting, or locker rooms required to comply with Section 11B-222.1.

**11B-222.3 Mirrors.** *Where mirrors are provided in dressing, fitting or locker rooms without individual compartments, at least one of each type shall comply with Section 11B-803.6. Where mirrors are provided in individual compartments at least one of each type complying with Section 11B-803.6 shall be provided in individual compartments in dressing, fitting or locker rooms required to comply with Section 11B-222.1.*

#### **11B-223 Medical care and long-term care facilities**

**11B-223.1 General.** In licensed medical care facilities and licensed long-term care facilities where the period of stay exceeds twenty-four hours, patient bedrooms or resident sleeping rooms shall be provided in accordance with Sections 11B-223 and 11B-805.

**Exception:** Toilet rooms that are part of critical or intensive care patient sleeping rooms shall not be required to comply with Section 11B-603.

**11B-223.1.1 Alterations.** Where patient bedrooms or resident sleeping rooms are altered or added, the requirements of Section 11B-223 shall apply only to the patient bedrooms or resident sleeping rooms being altered or added until the number of patient bedrooms or resident sleeping rooms complies with the minimum number required for new construction.

**11B-223.1.1.1 Area alterations.** *Patient bedrooms or resident sleeping rooms added or altered as part of a planned renovation of an entire wing, a department, or other discrete area of an existing medical facility shall comply with Section 11B-805.2 until the number of patient bedrooms or resident sleeping rooms provided within the area of renovation complies with the minimum number required for new construction by Section 11B-223.2 or 11B-223.3.*

**11B-223.1.1.2 Individual alterations.** *Patient bedrooms or resident sleeping rooms added or altered individually, and not as part of an alteration of an entire area, shall comply with Section 11B-805.2, until either: a) the number of patient bedrooms or resident sleeping rooms provided in the department or area containing the individually altered or added patient bedrooms or resident sleeping rooms complies with the minimum number required if the percentage requirements of Section 11B-223.2 or 11B-223.3 were applied to that department or area; or b) the overall number of patient bedrooms or resident sleeping rooms in the facility complies with the minimum number required for new construction by Section 11B-223.2 or 11B-223.3.*

**11B-223.1.1.3 Toilet and bathing facilities.** *Toilet/bathing rooms which are part of patient bedrooms added or altered and required to be accessible shall comply with Section 11B-805.2.4.*

**11B-223.2 Hospitals, rehabilitation facilities, psychiatric facilities and detoxification facilities.** Hospitals, rehabilitation facilities, psychiatric facilities and detoxification facilities shall comply with Section 11B-223.2. All public use and common use areas shall be accessible in compliance with this chapter.

**11B-223.2.1 Facilities not specializing in treating conditions that affect mobility.** In facilities not specializing in treating conditions that affect mobility, including hospitals, psychiatric and detoxification facilities, at least 10 percent, but no fewer than one, of the patient bedrooms or resident sleeping rooms shall provide mobility features complying with Section 11B-805. Accessible patient bedrooms or resident sleeping rooms shall be dispersed in a manner that is proportionate by type of medical specialty.

**11B-223.2.2 Facilities specializing in treating conditions that affect mobility.** In facilities specializing in treating conditions that affect mobility, 100 percent of the patient bedrooms shall provide mobility features complying with Section 11B-805.

**11B-223.2.3 On-call rooms.** Where physician or staff on-call sleeping rooms are provided, at least 10 percent, but no fewer than one, of the on-call rooms shall provide mobility features complying with Sections 11B-806.2.3, 11B-806.2.4 and 11B-806.2.6.

**11B-223.3 Long-term care facilities.** In licensed long-term care facilities, including skilled nursing facilities, intermediate care facilities and nursing homes, at least 50 percent, but no fewer than one, of each type of patient bedroom or resident sleeping room shall provide mobility features complying with Section 11B-805.

**11B-223.4 Professional offices of health care providers.** Professional offices of health care providers shall comply with Section 11B-805.

#### **11B-224 Transient lodging guest rooms**

**11B-224.1 General.** Hotels, motels, inns, dormitories, resorts and similar transient lodging facilities shall provide guest rooms in accordance with Section 11B-224.

**11B-224.1.1 Alterations.** Where guest rooms are altered or added, the requirements of Section 11B-224 shall apply only to the guest rooms being altered or added until the number of guest rooms complies with the minimum number required for new construction.

**11B-224.1.2 Guest room doors and doorways.** Entrances, doors, and doorways providing user passage into and within guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall comply with Section 11B-404.2.3. Bathrooms doors shall be either sliding or hung to swing in the direction of egress from the bathroom.

**Exception:** Shower and sauna doors in guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall not be required to comply with Section 11B-404.2.3.

**11B-224.1.3 Range of accommodations.** Accessible guest rooms or suites shall be dispersed among the various classes of sleeping accommodations to provide a range of options applicable to room sizes, costs, and amenities provided.

**11B-224.1.4 Housing at a place of education.** Housing at a place of education subject to this section shall comply with Sections 11B-224 and 11B-806 for transient lodging guest rooms. For the purposes of the application of this section, the term "sleeping room" is interchangeable with "guest room" as used in the transient lodging standards.

#### **Exceptions:**

1. Kitchens within housing units containing accessible sleeping rooms with mobility features (including suites and clustered sleeping rooms) or on floors containing accessible sleeping rooms with mobility features shall provide turning spaces that comply with Section 11B-809.2.2 and kitchen work surfaces that comply with Section 11B-804.3.
2. Multi-bedroom housing units containing accessible sleeping rooms with mobility features shall

have an accessible route throughout the unit in compliance with Section 11B-809.2.

3. Residential dwelling units that are provided by or on behalf of a place of education, which are leased on a year round basis exclusively to graduate students or faculty, and do not contain any public use or common use areas available for educational programming, are not subject to the transient lodging standards and shall comply with Sections 11B-233 and 11B-809.

**11B-224.1.5 Social service center establishments.** Group homes, halfway houses, shelters, or similar social service center establishments that provide either temporary sleeping accommodations or residential dwelling units subject to this section shall comply with this chapter.

**11B-224.1.5.1 More than twenty-five bed sleeping rooms.** In sleeping rooms with more than twenty-five beds, a minimum of 5 percent of the beds shall have clear floor space complying with Section 11B-806.2.3.

**11B-224.1.5.2 More than fifty bed facilities.** Facilities with more than fifty beds that provide common use bathing facilities, shall provide at least one roll-in shower with a seat that complies with Section 11B-608. When separate shower facilities are provided for men and women, at least one roll-in shower shall be provided for each group.

**11B-224.1.6 Guest room toilet and bathing rooms.** Where toilet and bathing rooms are provided in guest rooms that are not required to provide mobility features complying with Section 11B-806.2, toilet and bathing fixtures shall only be required to comply with Section 11B-603.6.

**11B-224.2 Guest rooms with mobility features.** In transient lodging facilities, guest rooms with mobility features complying with Section 11B-806.2 shall be provided in accordance with Table 11B-224.2, as follows.

**11B-224.2.1 Fifty or less guest room facilities.** Facilities that are subject to the same permit application on a common site that each have fifty or fewer guest rooms may be combined for the purposes of determining the required number of accessible rooms and type of accessible bathing facility.

**11B-224.2.2 More than fifty guest room facilities.** Facilities with more than fifty guest rooms shall be treated separately for the purposes of determining the required number of accessible rooms and type of accessible bathing facility.

**11B-224.3 Beds.** In guest rooms having more than 25 beds, 5 percent minimum of the beds shall have clear floor space complying with Section 11B-806.2.3.

**11B-224.4 Guest rooms with communication features.** In transient lodging facilities, guest rooms with communication features complying with Section 11B-806.3 shall be provided in accordance with Table 11B-224.4.

**11B-224.5 Dispersion.** Guest rooms required to provide mobility features complying with Section 11B-806.2 and guest rooms required to provide communication features

complying with *Section 11B-806.3* shall be dispersed among the various classes of guest rooms, and shall provide choices of types of guest rooms, number of beds, and other amenities comparable to the choices provided to other guests. Where the minimum number of guest rooms required to comply with *Section 11B-806* is not sufficient to allow for complete dispersion, guest rooms shall be dispersed in the following priority: guest room type, number of beds, and amenities. At least one guest room required to provide mobility features complying with *Section 11B-806.2* shall also provide communication features complying with *Section 11B-806.3*. Not more than 10 percent of guest rooms required to provide mobility features complying with *Section 11B-806.2* shall be used to satisfy the minimum number of guest rooms required to provide communication features complying with *Section 11B-806.3*.

**11B-224.6 Storage.** *Fixed or built-in storage facilities within guest rooms required to provide mobility features shall comply with Section 11B-225.*

#### **11B-225 Storage**

**11B-225.1 General.** Storage facilities shall comply with *Section 11B-225*.

**11B-225.2 Storage.** Where storage is provided in accessible spaces, at least one of each type shall comply with *Section 11B-811*.

**11B-225.2.1 Lockers.** Where lockers are provided, at least 5 percent, but no fewer than one of each type, shall comply with *Section 11B-811*.

**11B-225.2.2 Self-service shelving.** Self-service shelves shall be located on an accessible route complying with *Section 11B-402*. Self-service shelving shall not be required to comply with *Section 11B-308*.

**11B-225.2.3 Library book stacks.** *Book stacks available for public use shall be 54 inches (1372 mm) maximum above the finish floor.*

#### **Exceptions:**

1. *Book stacks available for public use may be higher than 54 inches (1372 mm) maximum above the finish floor when an attendant is available to assist persons with disabilities.*
2. *Book stacks restricted to employee use are not required to comply with these requirements.*

**TABLE 11B-224.2  
GUEST ROOMS WITH MOBILITY FEATURES**

TOTAL NUMBER OF GUEST ROOMS PROVIDED	MINIMUM NUMBER OF REQUIRED ROOMS WITHOUT ROLL-IN SHOWERS	MINIMUM NUMBER OF REQUIRED ROOMS WITH ROLL-IN SHOWERS	TOTAL NUMBER OF REQUIRED ROOMS
1 to 25	0	1	1
26 to 50	1	1	2
51 to 75	3	1	4
76 to 100	4	1	5
101 to 150	5	2	7
151 to 200	6	2	8
201 to 300	7	3	10
301 to 400	8	4	12
401 to 500	9	4	13
501 to 1000	2 percent of total	1 percent of total	3 percent of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000	10, plus 1 for each 100, or fraction thereof, over 1000	30, plus 2 for each 100, or fraction thereof, over 1000

**TABLE 11B-224.4  
GUEST ROOMS WITH COMMUNICATION FEATURES**

TOTAL NUMBER OF GUEST ROOMS PROVIDED	MINIMUM NUMBER OF REQUIRED GUEST ROOMS WITH COMMUNICATION FEATURES
1	1
2 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1000	5 percent of total
1001 and over	50, plus 3 for each 100 over 1000

**11B-225.3 Self-Service Storage Facilities.** Self-service storage facilities shall provide individual self-service storage spaces complying with these requirements in accordance with Table 11B-225.3.

**11B-225.3.1 Dispersion.** Individual self-service storage spaces shall be dispersed throughout the various classes of spaces provided. Where more classes of spaces are provided than the number required to be accessible, the number of spaces shall not be required to exceed that required by Table 11B-225.3. Self-service storage spaces complying with Table 11B-225.3 shall not be required to be dispersed among buildings in a multi-building facility.

**11B-226 Dining surfaces and work surfaces**

**11B-226.1 General.** Where dining surfaces are provided for the consumption of food or drink, at least 5 percent of the seating spaces and standing spaces at the dining surfaces shall comply with Section 11B-902. In addition, where work surfaces are provided for use by other than employees, at least 5 percent shall comply with Section 11B-902.

**Exceptions:**

1. Sales counters and service counters shall not be required to comply with Section 11B-902. See Section 11B-227.
2. Check writing surfaces provided at check-out aisles not required to comply with Section 11B-904.3 shall not be required to comply with Section 11B-902.

**11B-226.2 Dispersion.** Dining surfaces required to comply with Section 11B-902 shall be dispersed throughout the space or facility containing dining surfaces for each type of seating in a functional area. Work surfaces required to comply with Section 11B-902 shall be dispersed throughout the space or facility containing work surfaces.

**11B-226.3 Dining surfaces exceeding 34 inches in height.** Where food or drink is served for consumption at a counter exceeding 34 inches (864 mm) in height, a portion of the main counter 60 inches (1525 mm) minimum in length shall be provided in compliance with Section 11B-902.3.

**11B-227 Sales and service**

**11B-227.1 General.** Where provided, check-out aisles, sales counters, service counters, food service lines, queues, and waiting lines shall comply with Sections 11B-227 and 11B-904.

**11B-227.2 Check-out aisles.** Where check-out aisles are provided, check-out aisles complying with Section 11B-904.3 shall be provided in accordance with Table 11B-227.2. Where check-out aisles serve different functions, check-out aisles complying with Section 11B-904.3 shall be provided in accordance with Table 11B-227.2 for each function. Where check-out aisles are dispersed throughout the building or facility, check-out aisles complying with Section 11B-904.3 shall be dispersed. *When check-out aisles are open for customer use, a minimum of one accessible check-out aisle shall always be available. As check-out aisles are opened and closed based on fluctuating customer levels, the number of accessible check-out aisles available shall comply with Table 11B-227.2. When not all check-out aisles are accessible, accessible check-out aisles shall be identified by a sign complying with Section 11B-904.3.4.*

**Exception:** In existing buildings, where the selling space is under 5000 square feet (465 m<sup>2</sup>) no more than one check-out aisle complying with Section 11B-904.3 shall be required.

**11B-227.2.1 Altered check-out aisles.** Where check-out aisles are altered, at least one of each check-out aisle serving each function shall comply with Section 11B-904.3 until the number of check-out aisles complies with Section 11B-227.2.

**11B-227.3 Counters.** Where provided, at least one of each type of sales counter and service counter shall comply with Section 11B-904.4. Where counters are dispersed throughout the building or facility, counters complying with Section 11B-904.4 also shall be dispersed.

**11B-227.4 Food service lines.** Food service lines shall comply with Section 11B-904.5. Where self-service shelves are provided, at least 50 percent, but no fewer than one, of each type provided shall comply with Section 11B-308.

**11B-227.5 Queues and waiting lines.** Queues and waiting lines servicing counters or check-out aisles required to com-

**TABLE 11B-225.3  
SELF-SERVICE STORAGE FACILITIES**

TOTAL SPACES IN FACILITY	MINIMUM NUMBER OF SPACES REQUIRED TO BE ACCESSIBLE
1 to 200	5 percent, but no fewer than 1
201 and over	10, plus 2 percent of total number of units over 200

**TABLE 11B-227.2  
CHECK-OUT AISLES**

NUMBER OF CHECK-OUT AISLES OF EACH FUNCTION	MINIMUM NUMBER OF CHECK-OUT AISLES OF EACH FUNCTION REQUIRED TO COMPLY WITH 11B-904.3
1 to 4	1
5 to 8	2
9 to 15	3
16 and over	3, plus 20 percent of additional aisles

ply with *Sections 11B-904.3 or 11B-904.4* shall comply with *Section 11B-403*.

**11B-228 Depositories, vending machines, change machines, mail boxes, and fuel dispensers**

**11B-228.1 General.** Where provided, at least one of each type of depository, vending machine, change machine, and fuel dispenser shall comply with *Section 11B-309*.

**Exception:** Drive-up only depositories shall not be required to comply with *Section 11B-309*.

**11B-228.2 Mail boxes.** Where mail boxes are provided in an interior location, at least 5 percent, but no fewer than one, of each type shall comply with *Section 11B-309*. In residential facilities, where mail boxes are provided for each residential dwelling unit, mail boxes complying with *Section 11B-309* shall be provided for each residential dwelling unit required to provide mobility features complying with *Sections 11B-809.2 through 11B-809.4 and adaptable features complying with Chapter 11A, Division IV*.

**11B-229 Windows**

**11B-229.1 General.** Where glazed openings are provided in accessible rooms or spaces for operation by occupants, at least one opening shall comply with *Section 11B-309*. Each glazed opening required by an administrative authority to be operable shall comply with *Section 11B-309*.

**Exception:**

1. Glazed openings in residential dwelling units required to comply with *Section 11B-809* shall not be required to comply with *Section 11B-229*.
2. Glazed openings in guest rooms required to provide communication features and in guest rooms required to comply with *Section 11B-206.5.3* shall not be required to comply with *Section 11B-229*.

**11B-230 Two-way communication systems**

**11B-230.1 General.** Where a two-way communication system is provided to gain admittance to a building or facility or to restricted areas within a building or facility, the system shall comply with *Section 11B-708*.

**11B-231 Judicial facilities**

**11B-231.1 General.** Judicial facilities shall comply with *Section 11B-231*.

**11B-231.2 Courtrooms.** Each courtroom shall comply with *Section 11B-808*.

**11B-231.3 Holding cells.** Where provided, central holding cells and court-floor holding cells shall comply with *Section 11B-231.3*.

**11B-231.3.1 Central holding cells.** Where separate central holding cells are provided for adult male, juvenile male, adult female, or juvenile female, one of each type shall comply with *Section 11B-807.2*. Where central holding cells are provided and are not separated by age or sex, at least one cell complying with *Section 11B-807.2* shall be provided.

**11B-231.3.2 Court-floor holding cells.** Where separate court-floor holding cells are provided for adult male, juvenile

male, adult female, or juvenile female, each courtroom shall be served by one cell of each type complying with *Section 11B-807.2*. Where court-floor holding cells are provided and are not separated by age or sex, courtrooms shall be served by at least one cell complying with *Section 11B-807.2*. Cells may serve more than one courtroom.

**11B-231.4 Visiting areas.** Visiting areas shall comply with *Section 11B-231.4*.

**11B-231.4.1 Cubicles and counters.** At least 5 percent, but no fewer than one, of cubicles shall comply with *Section 11B-902* on both the visitor and detainee sides. Where counters are provided, at least one shall comply with *Section 11B-904.4.2* on both the visitor and detainee sides.

**Exception:** The detainee side of cubicles or counters at non-contact visiting areas not serving holding cells required to comply with *Section 11B-231* shall not be required to comply with *Sections 11B-902 or 11B-904.4.2*.

**11B-231.4.2 Partitions.** Where solid partitions or security glazing separate visitors from detainees at least one of each type of cubicle or counter partition shall comply with *Section 11B-904.6*.

**11B-232 Detention facilities and correctional facilities**

**11B-232.1 General.** Buildings, facilities, or portions thereof, in which people are detained for penal or correction purposes, or in which the liberty of the inmates is restricted for security reasons shall comply with *Section 11B-232*.

**11B-232.2 General holding cells and general housing cells.** General holding cells and general housing cells shall be provided in accordance with *Section 11B-232.2*.

**Exception: Reserved.**

**11B-232.2.1 Cells with mobility features.** At least 3 percent, but no fewer than one, of the total number of cells in a facility shall provide mobility features complying with *Section 11B-807.2*.

**11B-232.2.1.1 Beds.** In cells having more than 25 beds, at least 5 percent of the beds shall have clear floor space complying with *Section 11B-807.2.3*.

**11B-232.2.1.2 Dispersion.** Cells with mobility features shall be provided in each classification level.

**11B-232.2.1.3 Substitute cells.** When alterations are made to specific cells, detention and correctional facility operators may satisfy their obligation to provide the required number of cells with mobility features by providing the required mobility features in substitute cells (cells other than those where alterations are originally planned), provided that each substitute cell meets the following conditions:

1. Located within the same prison site.
2. Integrated with the other cells to the maximum extent feasible.
3. Has equal physical access as the altered cells to areas used by inmates or detainees for visitation, dining, recreation, educational programs, medi-

*cal services, work programs, religious services, and participation in other programs that the facility offers to inmates or detainees.*

**11B-232.2.1.4 Technically infeasible.** *Where it is technically infeasible to locate a substitute cell within the same prison site in compliance with Section 11B-232.2.1.3, a substitute cell shall be provided at another prison site within the correctional system.*

**11B-232.2.2 Cells with communication features.** At least 2 percent, but no fewer than one, of the total number of general holding cells and general housing cells equipped with audible emergency alarm systems and permanently installed telephones within the cell shall provide communication features complying with Section 11B-807.3.

**11B-232.3 Special holding cells and special housing cells.** Where special holding cells or special housing cells are provided, at least one cell serving each purpose shall provide mobility features complying with Section 11B-807.2. Cells subject to this requirement include, but are not limited to, those used for purposes of orientation, protective custody, administrative or disciplinary detention or segregation, detoxification, and medical isolation.

**Exception: Reserved.**

**11B-232.4 Medical care facilities.** Patient bedrooms or cells required to comply with Section 11B-223 shall be provided in addition to any medical isolation cells required to comply with Section 11B-232.3.

**11B-232.5 Visiting areas.** Visiting areas shall comply with Section 11B-232.5.

**11B-232.5.1 Cubicles and counters.** At least 5 percent, but no fewer than one, of cubicles shall comply with Section 11B-902 on both the visitor and detainee sides. Where counters are provided, at least one shall comply with Section 11B-904.4.2 on both the visitor and detainee or inmate sides.

**Exception:** The inmate or detainee side of cubicles or counters at non-contact visiting areas not serving holding cells or housing cells required to comply with Section 11B-232 shall not be required to comply with Section 11B-902 or 11B-904.4.2.

**11B-232.5.2 Partitions.** Where solid partitions or security glazing separate visitors from detainees or inmates at least one of each type of cubicle or counter partition shall comply with Section 11B-904.6.

## **11B-233 Residential facilities**

**11B-233.1 General.** *Public housing facilities with residential dwelling units available for public use shall comply with Section 11B-233. See Chapter 2, Section 202 of this code for the definition of Public Housing.*

**11B-233.2 Residential dwelling units provided by entities subject to HUD Section 504 Regulations.** Where public housing facilities with residential dwelling units are provided by entities subject to regulations issued by the Department of Housing and Urban Development (HUD) under Section 504 of the Rehabilitation Act of 1973, as amended, such entities

shall provide residential dwelling units with mobility features complying with Sections 11B-809.2 through 11B-809.4 in a number required by the applicable HUD regulations. Residential dwelling units required to provide mobility features complying with Sections 11B-809.2 through 11B-809.4 shall be on an accessible route as required by Section 11B-206. In addition, such entities shall provide residential dwelling units with communication features complying with Section 11B-809.5 in a number required by the applicable HUD regulations. Entities subject to Section 11B-233.2 shall not be required to comply with Section 11B-233.3.

**11B-233.3 Residential dwelling units provided by entities not subject to HUD Section 504 Regulations.** *Public housing facilities with residential dwelling units provided by entities not subject to regulations issued by the Department of Housing and Urban Development (HUD) under Section 504 of the Rehabilitation Act of 1973, as amended, shall comply with Section 11B-233.3.*

**11B-233.3.1 Minimum number: new construction.** Newly constructed public housing facilities with residential dwelling units shall comply with Section 11B-233.3.1.

**Exception:** Where facilities contain 15 or fewer residential dwelling units, the requirements of Sections 11B-233.3.1.1 and 11B-233.3.1.3 shall apply to the total number of residential dwelling units that are constructed under a single contract, or are developed as a whole, whether or not located on a common site.

**11B-233.3.1.1 Residential dwelling units with mobility features.** In public housing facilities with residential dwelling units, at least 5 percent, but no fewer than one unit, of the total number of residential dwelling units shall provide mobility features complying with Sections 11B-809.2 through 11B-809.4 and shall be on an accessible route as required by Section 11B-206.

**11B-233.3.1.2 Residential dwelling units with adaptable features.** In public housing facilities with residential dwelling units, adaptable residential dwelling units complying with Chapter 11A, Division IV – Dwelling Unit Features shall be provided as required by Sections 11B-233.3.1.2.1 through 11B-233.3.1.2.5. Adaptable residential dwelling units shall be on an accessible route as required by Section 11B-206.

**Exception:** The number of required adaptable residential dwelling units shall be reduced by the number of units required by Section 11B-233.3.1.1.

**11B-233.3.1.2.1 Elevator buildings.** Residential dwelling units on floors served by an elevator shall be adaptable.

**11B-233.3.1.2.2 Non-elevator buildings.** Ground floor residential dwelling units in non-elevator buildings shall be adaptable.

**11B-233.3.1.2.3 Ground floors above grade.** Where the first floor in a building containing residential dwelling units is a floor above grade, all units on that floor shall be adaptable.

**11B-233.3.1.2.4 Multi-story residential dwelling units.** In elevator buildings, public housing facilities

with multi-story residential dwelling units shall comply with the following:

**Exception:** In non-elevator buildings, a minimum of 10 percent but not less than one of the ground floor multi-story residential dwelling units shall comply with Section 11B-233.3.1.2.4, calculated using the total number of multi-story residential dwelling units in buildings on a site.

1. The primary entry of the multi-story residential dwelling unit shall be on an accessible route. In buildings with elevators the primary entry shall be on the floor served by the elevator.
2. At least one powder room or bathroom shall be located on the primary entry level.
3. Rooms or spaces located on the primary entry level shall be served by an accessible route and comply with Chapter 11A, Division IV – Dwelling Unit Features.

**11B-233.3.1.2.5 Public housing facility site impracticability.** The number of adaptable residential dwelling units required in non-elevator building public housing facilities shall be determined in accordance with Chapter 11A, Section 1150A.1. The remaining ground floor residential dwelling units shall comply with the following requirements:

1. Grab bar reinforcement complying with Section 11B-609.
2. Doors complying with Section 11B-404.
3. Communication features complying with Section 11B-809.5.5.
4. Electrical receptacle and switches complying with Section 11B-308.1.
5. Toilet and bathing facilities complying with Section 11B-809.4.
6. Kitchen sink removable cabinets complying with Section 11B-606.2, Exception 3.

**11B-233.3.1.3 Residential dwelling units with communication features.** In public housing facilities with residential dwelling units, at least 2 percent, but no fewer than one unit, of the total number of residential dwelling units shall provide communication features complying with Section 11B-809.5.

**11B-233.3.2 Residential dwelling units for sale.** Residential dwelling units designed and constructed or altered by public entities that will be offered for sale to individuals shall provide accessible features to the extent required by this chapter.

**Exception:** Existing residential dwellings or residential dwelling units acquired by public entities that will be offered for resale to individuals without additions or alterations shall not be required to comply with this chapter.

**11B-233.3.3 Additions.** Where an addition to an existing public housing facility results in an increase in the number

of residential dwelling units, the requirements of Section 11B-233.3.1 shall apply only to the residential dwelling units that are added until the total number of residential dwelling units complies with the minimum number required by Section 11B-233.3.1. Residential dwelling units required to comply with Sections 11B-233.3.1.1 and 11B-233.3.1.2 shall be on an accessible route as required by Section 11B-206.

**11B-233.3.4 Alterations.** Alterations to a public housing facility shall comply with Section 11B-233.3.4.

**Exception:** Where compliance with Sections 11B-809.2, 11B-809.3, or 11B-809.4 is technically infeasible, or where it is technically infeasible to provide an accessible route to a residential dwelling unit, the entity shall be permitted to alter or construct a comparable residential dwelling unit to comply with Sections 11B-809.2 through 11B-809.4 provided that the minimum number of residential dwelling units required by Sections 11B-233.3.1.1, 11B-233.3.1.2 and 11B-233.3.1.3, as applicable, is satisfied.

**11B-233.3.4.1 Alterations to vacated buildings.**

Where a building is vacated for the purposes of alteration for use as public housing, and the altered building contains more than 15 residential dwelling units, at least 5 percent of the residential dwelling units shall comply with Sections 11B-809.2 through 11B-809.4 and shall be on an accessible route as required by Section 11B-206. Residential dwelling units with adaptable features shall be provided in compliance with Section 11B-233.3.1.2. In addition, at least 2 percent of the residential dwelling units shall comply with Section 11B-809.5.

**Exception:** Where any portion of a building's exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings and a new building intended for use as public housing is constructed behind the existing exterior, the building is considered a new building for determining the application of this chapter.

**11B-233.3.4.2 Alterations to individual residential dwelling units.**

In public housing facilities with individual residential dwelling units, where a bathroom or a kitchen is substantially altered, and at least one other room is altered, the requirements of Section 11B-233.3.1 shall apply to the altered residential dwelling units until the total number of residential dwelling units complies with the minimum number required by Sections 11B-233.3.1.1, 11B-233.3.1.2, and 11B-233.3.1.3. Residential dwelling units required to comply with Sections 11B-233.3.1.1 and 11B-233.3.1.2 shall be on an accessible route as required by Section 11B-206.

**Exception:** Where public housing facilities contain 15 or fewer residential dwelling units, the requirements of Sections 11B-233.3.1.1, 11B-233.3.1.2, and 11B-233.3.1.3 shall apply to the total number of residential dwelling units that are altered under a single contract, or are developed as a whole, whether or not located on a common site.

**11B-233.3.5 Dispersion.** *In public housing facilities, residential dwelling units required to provide mobility features complying with Sections 11B-809.2 through 11B-809.4 and residential dwelling units required to provide communication features complying with Section 11B-809.5, and adaptable features complying with Chapter 11A, Division IV shall be dispersed among the various types of residential dwelling units in the facility and shall provide choices of residential dwelling units comparable to, and integrated with, those available to other residents.*

**Exception:** *In public housing facilities where multi-story residential dwelling units are one of the types of residential dwelling units provided, one-story residential dwelling units shall be permitted as a substitute for multi-story residential dwelling units where equivalent spaces and amenities are provided in the one-story residential dwelling unit.*

**11B-233.3.6 Graduate student and faculty housing at a place of education.** *Residential dwelling units that are provided by or on behalf of a place of education, which are leased on a year round basis exclusively to graduate students or faculty, and do not contain any public use or common use areas available for educational programming, are not subject to Section 11B-224 and shall comply with Sections 11B-233 and 11B-809.*

#### **11B-234 Amusement rides**

**11B-234.1 General.** Amusement rides shall comply with Section 11B-234.

**Exception:** Mobile or portable amusement rides shall not be required to comply with Section 11B-234.

**11B-234.2 Load and unload areas.** Load and unload areas serving amusement rides shall comply with Section 11B-1002.3.

**11B-234.3 Minimum number.** Amusement rides shall provide at least one wheelchair space complying with Section 11B-1002.4, or at least one amusement ride seat designed for

transfer complying with Section 11B-1002.5, or at least one transfer device complying with Section 11B-1002.6.

#### **Exceptions:**

1. Amusement rides that are controlled or operated by the rider shall not be required to comply with Section 11B-234.3.
2. Amusement rides designed primarily for children, where children are assisted on and off the ride by an adult, shall not be required to comply with Section 11B-234.3.
3. Amusement rides that do not provide amusement ride seats shall not be required to comply with Section 11B-234.3.

**11B-234.4 Existing amusement rides.** where existing amusement rides are altered, the alteration shall comply with Section 11B-234.4.

**11B-234.4.1 Load and unload areas.** Where load and unload areas serving existing amusement rides are newly designed and constructed, the load and unload areas shall comply with Section 11B-1002.3.

**11B-234.4.2 Minimum number.** Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with Section 11B-234.3.

#### **11B-235 Recreational boating facilities**

**11B-235.1 General.** Recreational boating facilities shall comply with Section 11B-235.

**11B-235.2 Boat slips.** Boat slips complying with Section 11B-1003.3.1 shall be provided in accordance with Table 11B-235.2. Where the number of boat slips is not identified, each 40 feet (12192 mm) of boat slip edge provided along the perimeter of the pier shall be counted as one boat slip for the purpose of this section.

**TABLE 11B-235.2  
BOAT SLIPS**

TOTAL NUMBER OF BOAT SLIPS PROVIDED IN FACILITY	MINIMUM NUMBER OF REQUIRED ACCESSIBLE BOAT SLIPS
1 to 25	1
26 to 50	2
51 to 100	3
101 to 150	4
151 to 300	5
301 to 400	6
401 to 500	7
501 to 600	8
601 to 700	9
701 to 800	10
801 to 900	11
901 to 1000	12
1001 and over	12, plus 1 for every 100, or fraction thereof, over 1000



**11B-235.2.1 Dispersion.** Boat slips complying with *Section 11B-1003.3.1* shall be dispersed throughout the various types of boat slips provided. Where the minimum number of boat slips required to comply with *Section 11B-1003.3.1* has been met, no further dispersion shall be required.

**11B-235.3 Boarding piers at boat launch ramps.** Where boarding piers are provided at boat launch ramps, at least 5 percent, but no fewer than one, of the boarding piers shall comply with *Section 11B-1003.3.2*.

#### **11B-236 Exercise machines and equipment**

**11B-236.1 General.** At least one of each type of exercise machine and equipment shall comply with *Section 11B-1004*.

#### **11B-237 Fishing piers and platforms**

**11B-237.1 General.** Fishing piers and platforms shall comply with *Section 11B-1005*.

#### **11B-238 Golf facilities**

**11B-238.1 General.** Golf facilities shall comply with *Section 11B-238*.

**11B-238.2 Golf courses.** Golf courses shall comply with *Section 11B-238.2*.

**11B-238.2.1 Teeing grounds.** Where one teeing ground is provided for a hole, the teeing ground shall be designed and constructed so that a golf car can enter and exit the teeing ground. Where two teeing grounds are provided for a hole, the forward teeing ground shall be designed and constructed so that a golf car can enter and exit the teeing ground. Where three or more teeing grounds are provided for a hole, at least two teeing grounds, including the forward teeing ground, shall be designed and constructed so that a golf car can enter and exit each teeing ground.

**Exception:** In existing golf courses, the forward teeing ground shall not be required to be one of the teeing grounds on a hole designed and constructed so that a golf car can enter and exit the teeing ground where compliance is not feasible due to terrain.

**11B-238.2.2 Putting greens.** Putting greens shall be designed and constructed so that a golf car can enter and exit the putting green.

**11B-238.2.3 Weather shelters.** Where provided, weather shelters shall be designed and constructed so that a golf car can enter and exit the weather shelter and shall comply with *Section 11B-1006.4*.

**11B-238.3 Practice putting greens, practice teeing grounds, and teeing stations at driving ranges.** At least 5 percent, but no fewer than one, of practice putting greens, practice teeing grounds, and teeing stations at driving ranges shall be designed and constructed so that a golf car can enter and exit the practice putting greens, practice teeing grounds, and teeing stations at driving ranges.

#### **11B-239 Miniature golf facilities**

**11B-239.1 General.** Miniature golf facilities shall comply with *Section 11B-239*.

**11B-239.2 Minimum number.** At least 50 percent of holes on miniature golf courses shall comply with *Section 11B-1007.3*.

**11B-239.3 Miniature golf course configuration.** Miniature golf courses shall be configured so that the holes complying with *Section 11B-1007.3* are consecutive. Miniature golf courses shall provide an accessible route from the last hole complying with *Section 11B-1007.3* to the course entrance or exit without requiring travel through any other holes on the course.

**Exception:** One break in the sequence of consecutive holes shall be permitted provided that the last hole on the miniature golf course is the last hole in the sequence.

#### **11B-240 Play areas**

**11B-240.1 General.** Play areas for children ages 2 and over shall comply with *Section 11B-240*. Where separate play areas are provided within a site for specific age groups, each play area shall comply with *Section 11B-240*.

##### **Exceptions:**

1. Play areas located in family child care facilities where the proprietor actually resides shall not be required to comply with *Section 11B-240*.
2. In existing play areas, where play components are relocated for the purposes of creating safe use zones and the ground surface is not altered or extended for more than one use zone, the play area shall not be required to comply with *Section 11B-240*.
3. Amusement attractions shall not be required to comply with *Section 11B-240*.
4. Where play components are altered and the ground surface is not altered, the ground surface shall not be required to comply with *Section 11B-1008.2.6* unless required by *Section 11B-202.4*.

**11B-240.1.1 Additions.** Where play areas are designed and constructed in phases, the requirements of *Section 11B-240* shall apply to each successive addition so that when the addition is completed, the entire play area complies with all the applicable requirements of *Section 11B-240*.

**11B-240.2 Play components.** Where provided, play components shall comply with *Section 11B-240.2*.

**11B-240.2.1 Ground level play components.** Ground level play components shall be provided in the number and types required by *Section 11B-240.2.1*. Ground level play components that are provided to comply with *Section 11B-240.2.1.1* shall be permitted to satisfy the additional number required by *Section 11B-240.2.1.2* if the minimum required types of play components are satisfied. Where two or more required ground level play components are provided, they shall be dispersed throughout the play area and integrated with other play components.

**11B-240.2.1.1 Minimum number and types.** Where ground level play components are provided, at least one of each type shall be on an accessible route and shall comply with *Section 11B-1008.4*.

**11B-240.2.1.2 Additional number and types.** Where elevated play components are provided, ground level play components shall be provided in accordance with Table 11B-240.2.1.2 and shall comply with Section 11B-1008.4.

**Exception:** If at least 50 percent of the elevated play components are connected by a ramp and at least 3 of the elevated play components connected by the ramp are different types of play components, the play area shall not be required to comply with Section 11B-240.2.1.2.

**11B-240.2.2 Elevated play components.** Where elevated play components are provided, at least 50 percent shall be on an accessible route and shall comply with Section 11B-1008.4.

#### **11B-241 Saunas and steam rooms**

**11B-241.1 General.** Where provided, saunas and steam rooms shall comply with Section 11B-612.

**Exception:** Where saunas or steam rooms are clustered at a single location, no more than 5 percent of the saunas and steam rooms, but no fewer than one, of each type in each cluster shall be required to comply with Section 11B-612.

#### **11B-242 Swimming pools, wading pools, and spas**

**11B-242.1 General.** Swimming pools, wading pools, and spas shall comply with Section 11B-242.

**11B-242.2 Swimming Pools.** At least two accessible means of entry shall be provided for swimming pools. Accessible means of entry shall be swimming pool lifts complying with Section 11B-1009.2; sloped entries complying with Section 11B-1009.3; transfer walls complying with Section 11B-1009.4; transfer systems complying with Section 11B-1009.5; and pool stairs complying with Section 11B-1009.6. At least one accessible means of entry provided shall comply with Sections 11B-1009.2 or 11B-1009.3.

##### **Exceptions:**

1. Where a swimming pool has less than 300 linear feet (91 m) of swimming pool wall, no more than one

accessible means of entry shall be required provided that the accessible means of entry is a swimming pool lift complying with Section 11B-1009.2 or sloped entry complying with Section 11B-1009.3.

2. Wave action pools, leisure rivers, sand bottom pools, and other pools where user access is limited to one area shall not be required to provide more than one accessible means of entry provided that the accessible means of entry is a swimming pool lift complying with Section 11B-1009.2, a sloped entry complying with Section 11B-1009.3, or a transfer system complying with Section 11B-1009.5.

3. Catch pools shall not be required to provide an accessible means of entry provided that the catch pool edge is on an accessible route.

**11B-242.3 Wading pools.** At least one accessible means of entry shall be provided for wading pools. Accessible means of entry shall comply with sloped entries complying with Section 11B-1009.3.

**11B-242.4 Spas.** At least one accessible means of entry shall be provided for spas. Accessible means of entry shall comply with swimming pool lifts complying with Section 11B-1009.2; transfer walls complying with Section 11B-1009.4; or transfer systems complying with Section 11B-1009.5.

**Exception:** Where spas are provided in a cluster, no more than 5 percent, but no fewer than one, spa in each cluster shall be required to comply with Section 11B-242.4.

#### **11B-243 Shooting facilities with firing positions**

**11B-243.1 General.** Where shooting facilities with firing positions are designed and constructed at a site, at least 5 percent, but no fewer than one, of each type of firing position shall comply with Section 11B-1010.

#### **11B-244 Religious facilities**

**11B-244.1 General.** Religious facilities shall be accessible in accordance with the provisions of this code. Where specific areas within religious facilities contain more than one use, each portion shall comply with the applicable requirements for that use.

**TABLE 11B-240.2.1.2  
NUMBER AND TYPES OF GROUND LEVEL PLAY COMPONENTS REQUIRED TO BE ON ACCESSIBLE ROUTES**

NUMBER OF ELEVATED PLAY COMPONENTS PROVIDED	MINIMUM NUMBER OF GROUND LEVEL PLAY COMPONENTS REQUIRED TO BE ON AN ACCESSIBLE ROUTE	MINIMUM NUMBER OF DIFFERENT TYPES OF GROUND LEVEL PLAY COMPONENTS REQUIRED TO BE ON AN ACCESSIBLE ROUTE
1	Not applicable	Not applicable
2 to 4	1	1
5 to 7	2	2
8 to 10	3	3
11 to 13	4	3
14 to 16	5	3
17 to 19	6	3
20 to 22	7	4
23 to 25	8	4
26 and over	8, plus 1 for each additional 3, or fraction thereof, over 25	5

**11B-245 Commercial facilities located in private residences**

**11B-245.1 General.** Commercial facilities located in private residences shall comply with Section 11B-245.

**11B-245.2 Application.** When a commercial facility is located in a private residence, that portion used exclusively in the operation of the commercial facility or that portion used both for the commercial facility and for residential purposes is covered by the new construction and alterations requirements of this chapter.

**Exception:** The portion of the residence used exclusively as a residence is not required to be accessible in accordance with this chapter.

**11B-245.3 Accessible elements required.** The accessible portion of the residence extends to those elements used to enter the commercial facility, including the front sidewalk, if any, the door or entryway, and hallways; and those portions of the residence, interior or exterior, available to or used by employees or visitors of the commercial facility, including restrooms.

**11B-246 Outdoor developed areas**

**11B-246.1 General.** Outdoor developed areas shall comply with Section 11B-246.

**Exceptions:**

1. Where the enforcing agency finds that, in specific areas, the natural environment would be materially damaged by compliance with these regulations, such areas shall be subject to these regulations only to the extent that such material damage would not occur.
2. Automobile access or accessible routes are not required when the enforcing agency determines compliance with this chapter would create an unreasonable hardship as defined in Chapter 2, Section 202.

**11B-246.2 Camping facilities.** In camping facilities where campsites are provided, at least two campsites and one additional campsite for each 100 campsites or fraction thereof, shall be accessed by and connected to sanitary facilities by travel routes with a maximum slope of 1:12. Permanent toilet and bathing facilities serving campsites shall comply with Section 11B-603.

**11B-246.3 Beaches.** Beaches shall be accessible.

**11B-246.4 Day use areas and vista points.** Day use areas, vista points, and similar areas shall be accessible.

**11B-246.5 Picnic areas.** Where picnic tables are provided, at least one picnic table, and one additional table for each 20 tables or fraction thereof, shall be accessible and comply with Section 11B-902.

**11B-246.6 Parking lots.** Parking lots shall comply with Sections 11B-208 and 11B-502 and shall be provided with curb cuts leading to adjacent walks, paths or trails.

**11B-246.7 Trails and paths.** Trails, paths and nature walk areas, or portions of them, shall be constructed with gradients permitting at least partial use by wheelchair occupants.

Buildings and other functional areas shall be served by paths or walks with firm and stable surfaces.

**11B-246.8 Nature trails.** Nature trails and similar educational and informational areas shall be accessible to individuals with vision impairments by the provision of rope guidelines, raised Arabic numerals and symbols, or other similar guide and assistance devices.

**11B-247 Detectable warnings and detectable directional texture****11B-247.1 Detectable warnings.**

**11B-247.1.1 General.** Detectable warnings shall be provided in accordance with Section 11B-247.1 and shall comply with Section 11B-705.1.

**11B-247.1.2 Where required.** Detectable warnings shall be provided where required by Section 11B-247.1.2.

**11B-247.1.2.1 Platform edges.** Platform boarding edges shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.1.

**11B-247.1.2.2 Curb ramps.** Curb ramps shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.2.

**11B-247.1.2.3 Islands or cut-through medians.** Islands or cut-through medians shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.3.

**11B-247.1.2.4 Bus stops.** Bus stop pads shall provide a square curb surface or detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.4.

**11B-247.1.2.5 Hazardous vehicular areas.** If a walk crosses or adjoins a vehicular way, and the walking surfaces are not separated by curbs, railings or other elements between the pedestrian areas and vehicular areas, the boundary between the areas shall be defined by a continuous detectable warning complying with Sections 11B-705.1.1 and 11B-705.1.2.5.

**11B-247.1.2.6 Reflecting pools.** The edges of reflecting pools shall be protected by railings, walls, warning curbs or detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.6.

**11B-247.1.2.7 Track crossings.** Where it is necessary to cross tracks to reach transit boarding platforms, detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.7 shall be provided.

**11B-247.2 Detectable directional texture.** At transit boarding platforms, the pedestrian access shall be identified with a detectable directional texture complying with Section 11B-705.2.

## DIVISION 3: BUILDING BLOCKS

### 11B-301 General

**11B-301.1 Scope.** The provisions of *Division 3* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

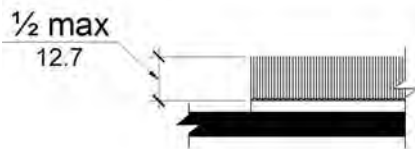
### 11B-302 Floor or ground surfaces

**11B-302.1 General.** Floor and ground surfaces shall be stable, firm, and slip resistant and shall comply with *Section 11B-302*.

#### Exceptions:

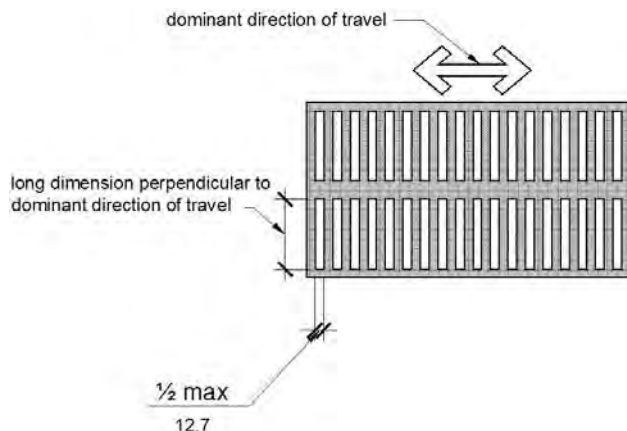
1. Within animal containment areas, floor and ground surfaces shall not be required to be stable, firm, and slip resistant.
2. Areas of sport activity shall not be required to comply with *Section 11B-302*.

**11B-302.2 Carpet.** Carpet or carpet tile shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. Carpet or carpet tile shall have a level loop, textured loop, level cut pile, level cut/uncut pile texture. Pile height shall be  $\frac{1}{2}$  inch (12.7 mm) maximum. Exposed edges of carpet shall be fastened to floor surfaces and shall have trim on the entire length of the exposed edge. Carpet edge trim shall comply with *Section 11B-303*.



**FIGURE 11B-302.2  
CARPET PILE HEIGHT**

**11B-302.3 Openings.** Openings in floor or ground surfaces shall not allow passage of a sphere more than  $\frac{1}{2}$  inch (12.7 mm) diameter except as allowed in *Sections 11B-407.4.3*,



**FIGURE 11B-302.3  
ELONGATED OPENINGS IN FLOOR OR GROUND SURFACES**

*11B-409.4.3*, *11B-410.4*, *11B-810.5.3* and *11B-810.10*. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel.

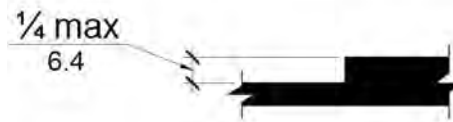
### 11B-303 Changes in level

**11B-303.1 General.** Where changes in level are permitted in floor or ground surfaces, they shall comply with *Section 11B-303*.

#### Exceptions:

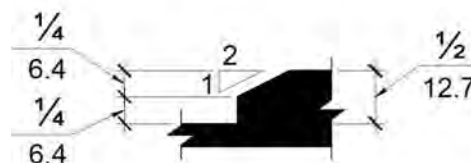
1. Animal containment areas shall not be required to comply with *Section 11B-303*.
2. Areas of sport activity shall not be required to comply with *Section 11B-303*.

**11B-303.2 Vertical.** Changes in level of  $\frac{1}{4}$  inch (6.4 mm) high maximum shall be permitted to be vertical *and without edge treatment*.



**FIGURE 11B-303.2  
VERTICAL CHANGE IN LEVEL**

**11B-303.3 Beveled.** Changes in level between  $\frac{1}{4}$  inch (6.4 mm) high minimum and  $\frac{1}{2}$  inch (12.7 mm) high maximum shall be beveled with a slope not steeper than 1:2.



**FIGURE 11B-303.3  
BEVELED CHANGE IN LEVEL**

**11B-303.4 Ramps.** Changes in level greater than  $\frac{1}{2}$  inch (12.7 mm) high shall be ramped, and shall comply with *Section 11B-405* or *11B-406*.

**11B-303.5 Warning curbs.** Abrupt changes in level exceeding 4 inches (102 mm) in a vertical dimension between walks, sidewalks or other pedestrian ways and adjacent surfaces or features shall be identified by warning curbs at least 6 inches (152 mm) in height above the walk or sidewalk surface.

#### Exceptions:

1. A warning curb is not required between a walk or sidewalk and an adjacent street or driveway.

2. A warning curb is not required when a guard or handrail is provided with a guide rail centered 2 inches (51 mm) minimum and 4 inches (102 mm) maximum above the surface of the walk or sidewalk.

### 11B-304 Turning space

**11B-304.1 General.** Turning space shall comply with Section 11B-304.

**11B-304.2 Floor or ground surfaces.** Floor or ground surfaces of a turning space shall comply with Section 11B-302. Changes in level are not permitted.

**Exception:** Slopes not steeper than 1:48 shall be permitted.

**11B-304.3 Size.** Turning space shall comply with Section 11B-304.3.1 or 11B-304.3.2.

**11B-304.3.1 Circular space.** The turning space shall be a space of 60 inches (1524 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with Section 11B-306.

**11B-304.3.2 T-Shaped space.** The turning space shall be a T-shaped space within a 60 inch (1524 mm) square minimum with arms and base 36 inches (914 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with Section 11B-306 only at the end of either the base or one arm.

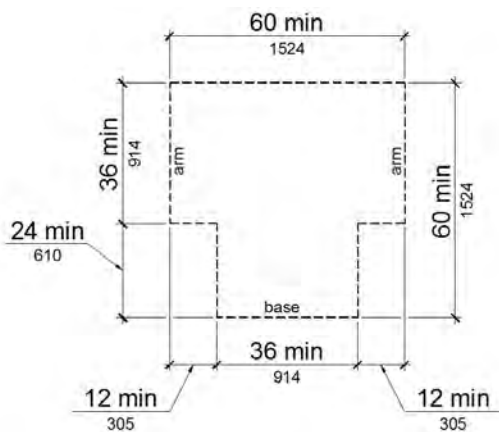


FIGURE 11B-304.3.2  
T-SHAPED TURNING SPACE

**11B-304.4 Door swing.** Doors shall be permitted to swing into turning spaces.

### 11B-305 Clear floor or ground space

**11B-305.1 General.** Clear floor or ground space shall comply with Section 11B-305.

**11B-305.2 Floor or ground surfaces.** Floor or ground surfaces of a clear floor or ground space shall comply with Section 11B-302. Changes in level are not permitted.

**Exception:** Slopes not steeper than 1:48 shall be permitted.

**11B-305.3 Size.** The clear floor or ground space shall be 30 inches (762 mm) minimum by 48 inches (1219 mm) minimum.

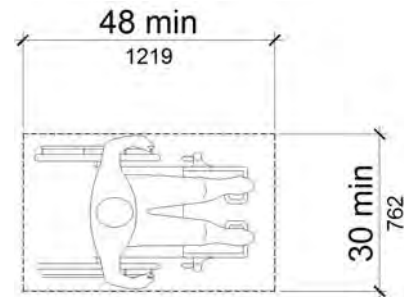


FIGURE 11B-305.3  
CLEAR FLOOR OR GROUND SPACE

**11B-305.4 Knee and toe clearance.** Unless otherwise specified, clear floor or ground space shall be permitted to include knee and toe clearance complying with Section 11B-306.

**11B-305.5 Position.** Unless otherwise specified, clear floor or ground space shall be positioned for either forward or parallel approach to an element.

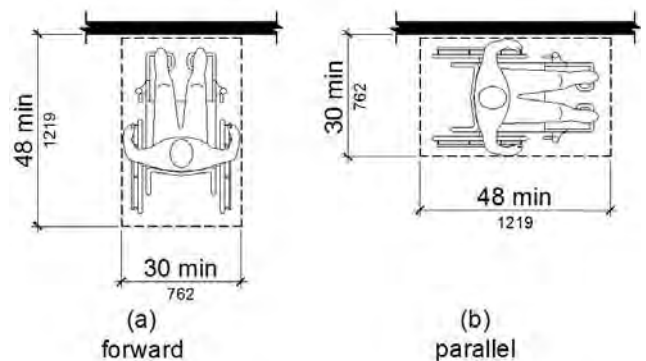


FIGURE 11B-305.5  
POSITION OF CLEAR FLOOR OR GROUND SPACE

**11B-305.6 Approach.** One full unobstructed side of the clear floor or ground space shall adjoin an accessible route or adjoin another clear floor or ground space.

**11B-305.7 Maneuvering clearance.** Where a clear floor or ground space is located in an alcove or otherwise confined on all or part of three sides, additional maneuvering clearance shall be provided in accordance with Sections 11B-305.7.1 and 11B-305.7.2.

**11B-305.7.1 Forward approach.** Alcoves shall be 36 inches (914 mm) wide minimum where the depth exceeds 24 inches (610 mm).

**11B-305.7.2 Parallel approach.** Alcoves shall be 60 inches (1524 mm) wide minimum where the depth exceeds 15 inches (381 mm).

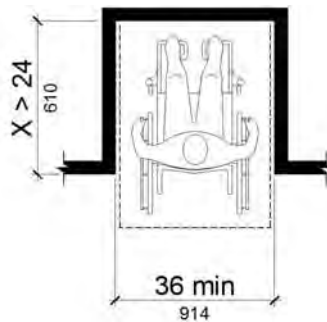


FIGURE 11B-305.7.1  
MANEUVERING CLEARANCE IN AN  
ALCOVE, FORWARD APPROACH

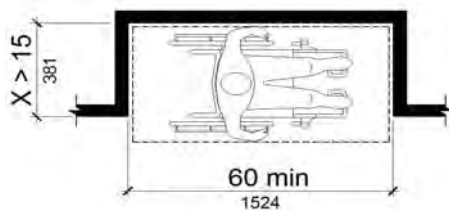


FIGURE 11B-305.7.2  
MANEUVERING CLEARANCE IN  
AN ALCOVE, PARALLEL APPROACH

### 11B-306 Knee and toe clearance

**11B-306.1 General.** Where space beneath an element is included as part of clear floor or ground space or turning space, the space shall comply with Section 11B-306. Additional space shall not be prohibited beneath an element but shall not be considered as part of the clear floor or ground space or turning space.

#### 11B-306.2 Toe clearance

**11B-306.2.1 General.** Space under an element between

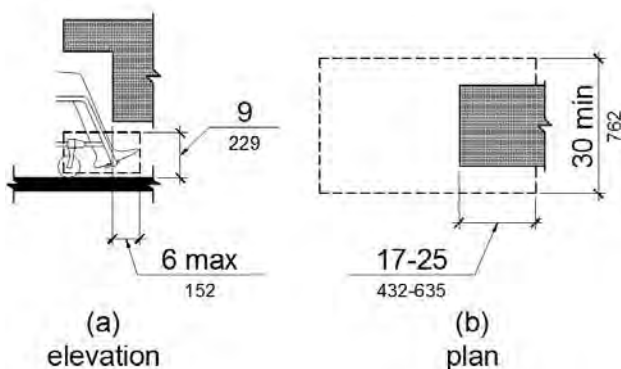


FIGURE 11B-306.2  
TOE CLEARANCE

the finish floor or ground and 9 inches (229 mm) above the finish floor or ground shall be considered toe clearance and shall comply with Section 11B-306.2.

**11B-306.2.2 Maximum depth.** Toe clearance shall extend 25 inches (635 mm) maximum under an element.

**Exception:** Toe clearance shall extend 19 inches (483 mm) maximum under lavatories required to be accessible by Section 11B-213.3.4.

**11B-306.2.3 Minimum required depth.** Where toe clearance is required at an element as part of a clear floor space, the toe clearance shall extend 17 inches (432 mm) minimum under the element.

#### Exceptions:

1. The toe clearance shall extend 19 inches (483 mm) minimum under sinks required to be accessible by Section 11B-212.3.
2. The toe clearance shall extend 19 inches (483 mm) minimum under built-in dining and work surfaces required to be accessible by Section 11B-226.1.

**11B-306.2.4 Additional clearance.** Space extending greater than 6 inches (152 mm) beyond the available knee clearance at 9 inches (229 mm) above the finish floor or ground shall not be considered toe clearance.

**11B-306.2.5 Width.** Toe clearance shall be 30 inches (762 mm) wide minimum.

### 11B-306.3 Knee clearance.

**11B-306.3.1 General.** Space under an element between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor or ground shall be considered knee clearance and shall comply with Section 11B-306.3.

**Exception:** At lavatories required to be accessible by Section 11B-213.3.4, space between 9 inches (229 mm) and 29 inches (737 mm) above the finish floor or ground, shall be considered knee clearance.

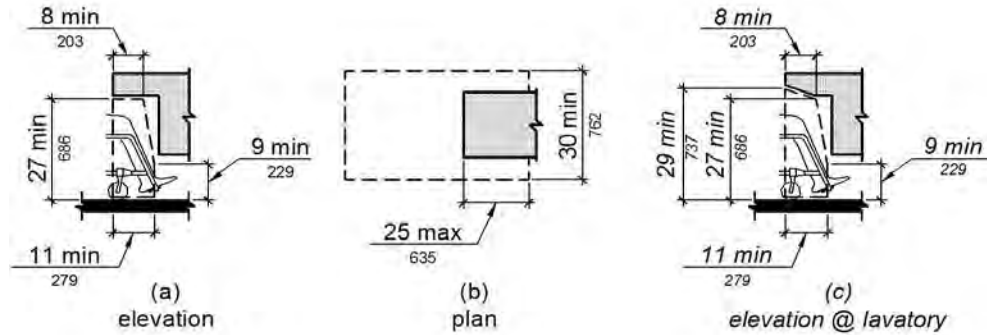
**11B-306.3.2 Maximum depth.** Knee clearance shall extend 25 inches (635 mm) maximum under an element at 9 inches (229 mm) above the finish floor or ground.

**11B-306.3.3 Minimum required depth.** Where knee clearance is required under an element as part of a clear floor space, the knee clearance shall be 11 inches (279 mm) deep minimum at 9 inches (229 mm) above the finish floor or ground, and 8 inches (203 mm) deep minimum at 27 inches (686 mm) above the finish floor or ground.

#### Exceptions:

1. At lavatories required to be accessible by Section 11B-213.3.4, the knee clearance shall be 27 inches (686 mm) high minimum above the finish floor or ground at a depth of 8 inches (203 mm) minimum increasing to 29 inches (737 mm) high minimum above the finish floor or ground at the front edge of a counter with a built-in lavatory or at the front edge of a wall-mounted lavatory fixture.
2. At dining and work surfaces required to be accessible by Section 11B-226.1, knee clearance shall extend 19 inches (483 mm) deep minimum at 27 inches (686 mm) above the finish floor or ground.





**FIGURE 11B-306.3**  
**KNEE CLEARANCE**

**11B-306.3.4 Clearance reduction.** Between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor or ground, the knee clearance shall be permitted to reduce at a rate of 1 inch (25 mm) in depth for each 6 inches (152 mm) in height.

**Exception:** The knee clearance shall not be reduced at built-in dining and work surfaces required to be accessible by Section 11B-226.1.

**11B-306.3.5 Width.** Knee clearance shall be 30 inches (762 mm) wide minimum.

### 11B-307 Protruding objects

**11B-307.1 General.** Protruding objects shall comply with Section 11B-307.

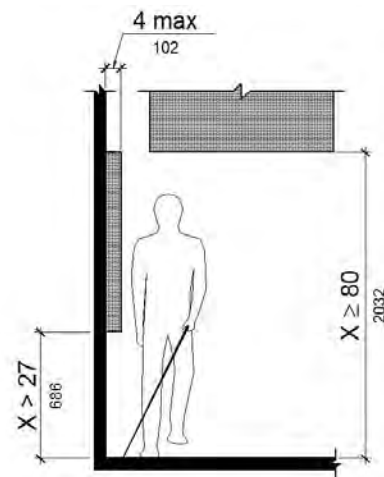
**11B-307.2 Protrusion limits.** Objects with leading edges more than 27 inches (686 mm) and not more than 80 inches (2032 mm) above the finish floor or ground shall protrude 4 inches (102 mm) maximum horizontally into the circulation path.

**Exception:** Handrails shall be permitted to protrude 4½ inches (114 mm) maximum.

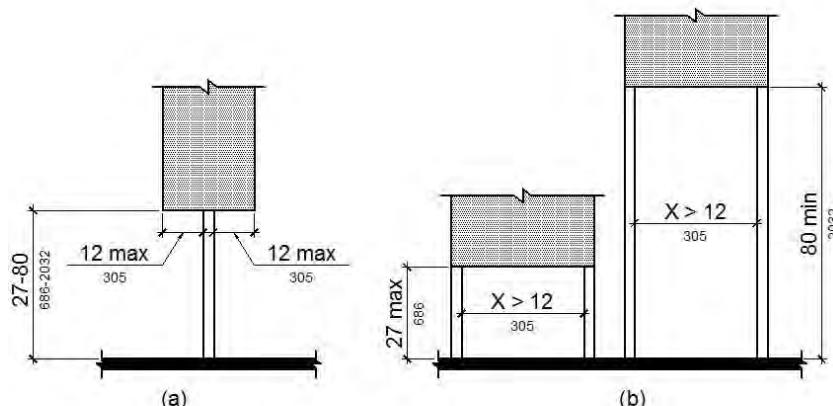
**11B-307.3 Post-mounted objects.** Free-standing objects mounted on posts or pylons shall overhang circulation paths 12 inches (305 mm) maximum when located 27 inches (686 mm) minimum and 80 inches (2032 mm) maximum above the finish floor or ground. Where a sign or other obstruction is mounted between posts or pylons and the clear distance

between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (686 mm) maximum or 80 inches (2032 mm) minimum above the finish floor or ground.

**Exception:** The sloping portions of handrails serving stairs and ramps shall not be required to comply with Section 11B-307.3.



**FIGURE 11B-307.2**  
**LIMITS OF PROTRUDING OBJECTS**



**FIGURE 11B-307.3**  
**POST-MOUNTED PROTRUDING OBJECTS**

**11B-307.3.1 Edges and corners.** Where signs or other objects are mounted on posts or pylons, and their bottom edges are less than 80 inches (2032 mm) above the floor or ground surface, the edges of such signs and objects shall be rounded or eased and the corners shall have a minimum radius of  $\frac{1}{8}$  inch (3.2 mm).

**11B-307.4 Vertical clearance.** Vertical clearance shall be 80 inches (2032 mm) high minimum. Guardrails or other barriers shall be provided where the vertical clearance is less than 80 inches (2032 mm) high. The leading edge of such guardrail or barrier shall be located 27 inches (686 mm) maximum above the finish floor or ground. Where a guy support is used parallel to a circulation path, including but not limited to sidewalks, a guy brace, sidewalk guy or similar device shall be used to prevent an overhanging obstruction.

**Exception:** Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

**11B-307.5 Required clear width.** Protruding objects shall

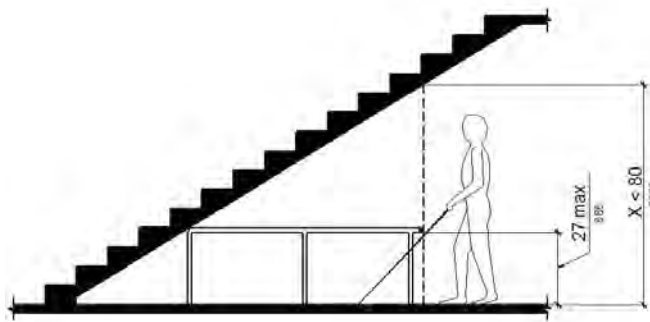


FIGURE 11B-307.4  
VERTICAL CLEARANCE

not reduce the clear width required for accessible routes.

### 11B-308 Reach ranges

**11B-308.1 General.** Reach ranges shall comply with Section 11B-308.

**11B-308.1.1 Electrical switches.** Controls and switches intended to be used by the occupant of a room or area to control lighting and receptacle outlets, appliances or cooling, heating and ventilating equipment, shall comply with Section 11B-308 except the low reach shall be measured to the bottom of the outlet box and the high reach shall be measured to the top of the outlet box.

**11B-308.1.2 Electrical receptacle outlets.** Electrical receptacle outlets on branch circuits of 30 amperes or less and communication system receptacles shall comply with Section 11B-308 except the low reach shall be measured to the bottom of the outlet box and the high reach shall be measured to the top of the outlet box.

### 11B-308.2 Forward reach.

**11B-308.2.1 Unobstructed.** Where a forward reach is unobstructed, the high forward reach shall be 48 inches (1219 mm) maximum and the low forward reach shall be

15 inches (381 mm) minimum above the finish floor or ground.

**11B-308.2.2 Obstructed high reach.** Where a high forward reach is over an obstruction, the clear floor space shall extend beneath the element for a distance not less

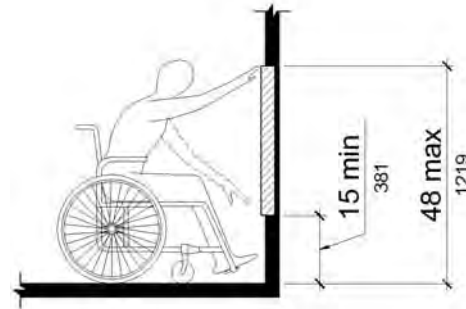


FIGURE 11B-308.2.1  
UNOBSTRUCTED FORWARD REACH

than the required reach depth over the obstruction. The high forward reach shall be 48 inches (1219 mm) maximum where the reach depth is 20 inches (508 mm) maximum. Where the reach depth exceeds 20 inches (508 mm), the high forward reach shall be 44 inches (1118 mm) maximum and the reach depth shall be 25 inches (635 mm) maximum.

### 11B-308.3 Side reach.

**11B-308.3.1 Unobstructed.** Where a clear floor or ground

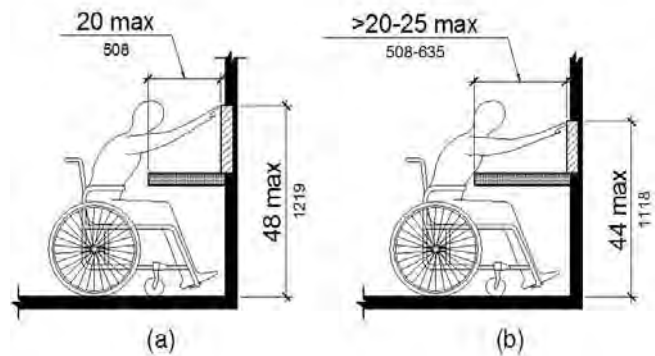


FIGURE 11B-308.2.2  
OBSTRUCTED HIGH FORWARD REACH

space allows a parallel approach to an element and the side reach is unobstructed, the high side reach shall be 48 inches (1219 mm) maximum and the low side reach shall be 15 inches (381 mm) minimum above the finish floor or ground.

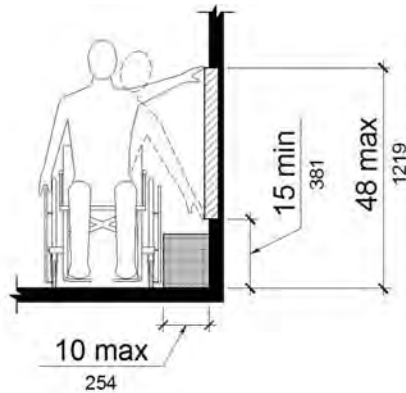
### Exceptions:

1. An obstruction shall be permitted between the clear floor or ground space and the element where the depth of the obstruction is 10 inches (254 mm) maximum.



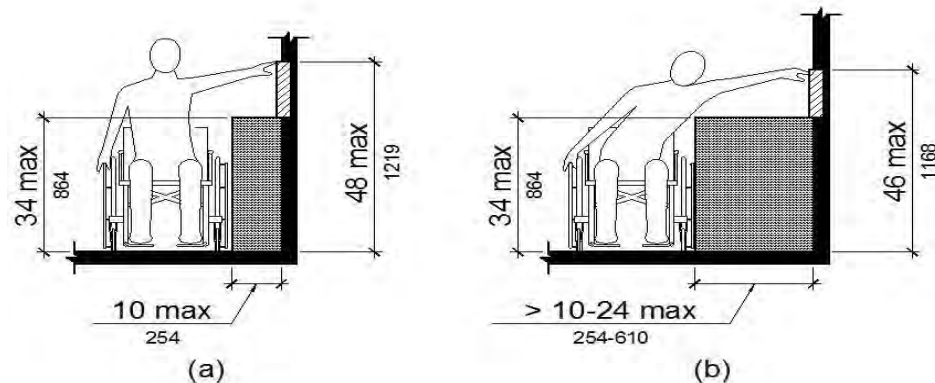
- Operable parts of fuel dispensers shall be permitted to be 54 inches (1372 mm) maximum measured from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

**11B-308.3.2 Obstructed high reach.** Where a clear floor or ground space allows a parallel approach to an element



**FIGURE 11B-308.3.1**  
**UNOBSTRUCTED SIDE REACH**

and the high side reach is over an obstruction, the height of the obstruction shall be 34 inches (864 mm) maximum and the depth of the obstruction shall be 24 inches (610 mm) maximum. The high side reach shall be 48 inches (1219 mm) maximum for a reach depth of 10 inches (254 mm) maximum. Where the reach depth exceeds 10 inches (254 mm), the high side reach shall be 46 inches (1168 mm) maximum for a reach depth of 24 inches (610 mm) maximum.



**FIGURE 11B-308.3.2**  
**OBSTRUCTED HIGH SIDE REACH**

#### Exceptions:

- The top of washing machines and clothes dryers shall be permitted to be 36 inches (914 mm) maximum above the finish floor.
- Operable parts of fuel dispensers shall be permitted to be 54 inches (1372 mm) maximum measured from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

#### 11B-309 Operable parts

**11B-309.1 General.** Operable parts shall comply with Section 11B-309.

**11B-309.2 Clear floor space.** A clear floor or ground space complying with Section 11B-305 shall be provided.

**11B-309.3 Height.** Operable parts shall be placed within one or more of the reach ranges specified in Section 11B-308.

**11B-309.4 Operation.** Operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum.

**Exception:** Gas pump nozzles shall not be required to provide operable parts that have an activating force of 5 pounds (22.2 N) maximum.

## DIVISION 4: ACCESSIBLE ROUTES

### 11B-401 General

**11B-401.1 Scope.** The provisions of *Division 4* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-402 Accessible routes

**11B-402.1 General.** Accessible routes shall comply with 11B-402.

**11B-402.2 Components.** Accessible routes shall consist of one or more of the following components: walking surfaces with a running slope not steeper than 1:20, doorways, ramps, curb ramps excluding the flared sides, elevators, and platform lifts. All components of an accessible route shall comply with the applicable requirements of *Division 4*.

### 11B-403 Walking surfaces

**11B-403.1 General.** Walking surfaces that are a part of an accessible route shall comply with *Section 11B-403*.

**11B-403.2 Floor or ground surface.** Floor or ground surfaces shall comply with *Section 11B-302*.

**11B-403.3 Slope.** The running slope of walking surfaces shall not be steeper than 1:20. The cross slope of walking surfaces shall not be steeper than 1:48.

**Exception:** *The running slope of sidewalks shall not exceed the general grade established for the adjacent street or highway.*

**11B-403.4 Changes in level.** Changes in level shall comply with *Section 11B-303*.

**11B-403.5 Clearances.** Walking surfaces shall provide clearances complying with *Section 11B-403.5*.

**Exception:** Within employee work areas, clearances on common use circulation paths shall be permitted to be decreased by work area equipment provided that the decrease is essential to the function of the work being performed.

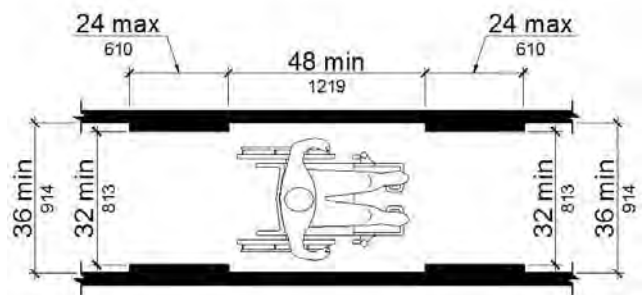
**11B-403.5.1 Clear width.** Except as provided in *Sections 11B-403.5.2* and *11B-403.5.3*, the clear width of walking surfaces shall be 36 inches (914 mm) minimum.

#### Exceptions:

1. The clear width shall be permitted to be reduced to 32 inches (813 mm) minimum for a length of 24 inches (610 mm) maximum provided that reduced width segments are separated by segments that are 48 inches (1219 mm) long minimum and 36 inches (914 mm) wide minimum.
2. The clear width for walking surfaces in corridors serving an occupant load of 10 or more shall be 44 inches (1118 mm) minimum.
3. The clear width for sidewalks and walks shall be 48 inches (1219 mm) minimum. When, because of right-of-way restrictions, natural barriers or

*other existing conditions, the enforcing agency determines that compliance with the 48-inch (1219 mm) clear sidewalk width would create an unreasonable hardship, the clear width may be reduced to 36 inches (914 mm).*

4. The clear width for aisles shall be 36 inches (914 mm) minimum if serving elements on only one side, and 44 inches (1118 mm) minimum if serving elements on both sides.



**FIGURE 11B-403.5.1  
CLEAR WIDTH OF AN ACCESSIBLE ROUTE**

**11B-403.5.2 Clear width at turn.** Where the accessible route makes a 180 degree turn around an element which is less than 48 inches (1219 mm) wide, clear width shall be 42 inches (1067 mm) minimum approaching the turn, 48 inches (1219 mm) minimum at the turn and 42 inches (1067 mm) minimum leaving the turn.

**Exception:** Where the clear width at the turn is 60 inches (1524 mm) minimum compliance with *Section 11B-403.5.2* shall not be required.

**11B-403.5.3 Passing spaces.** An accessible route with a clear width less than 60 inches (1524 mm) shall provide passing spaces at intervals of 200 feet (60,960 mm) maximum. Passing spaces shall be either: a space 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum; or, an intersection of two walking surfaces providing a T-shaped space complying with *Section 11B-304.3.2* where the base and arms of the T-shaped space extend 48 inches (1219 mm) minimum beyond the intersection.

**11B-403.6 Handrails.** Where handrails are provided along walking surfaces with running slopes not steeper than 1:20 they shall comply with *Section 11B-505*.

**11B-403.7 Continuous gradient.** All walks with continuous gradients shall have resting areas, 60 inches (1524 mm) in length, at intervals of 400 feet (121,920 mm) maximum. The resting area shall be at least as wide as the walk. The slope of the resting area in all directions shall be 1:48 maximum.

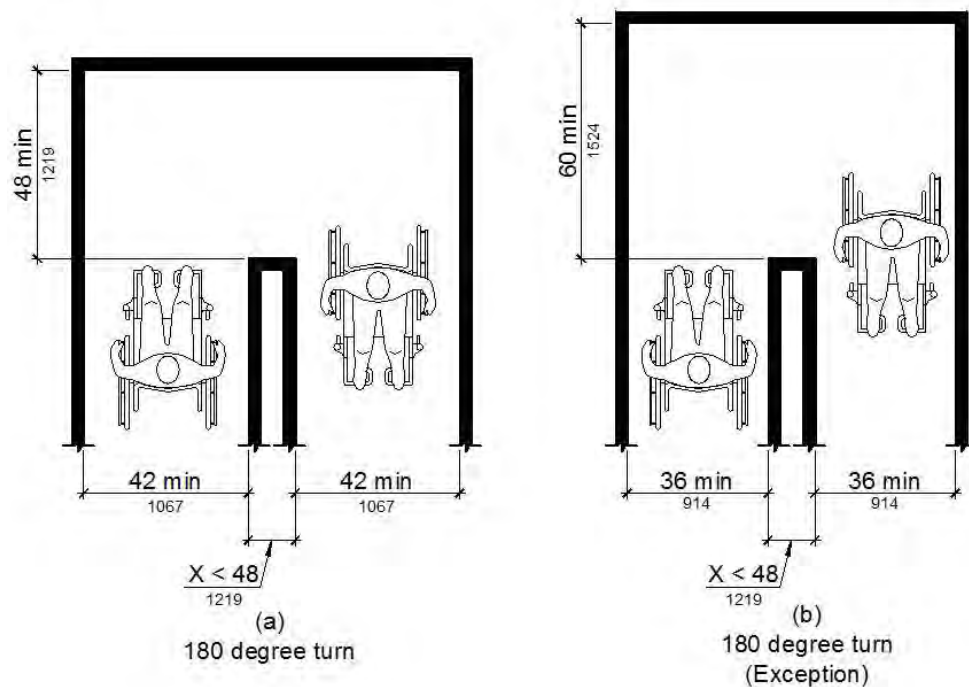


FIGURE 11B-403.5.2  
CLEAR WIDTH AT TURN

### 11B-404 Doors, doorways, and gates

**11B-404.1 General.** Doors, doorways, and gates that are part of an accessible route shall comply with Section 11B-404.

**Exceptions:**

1. Doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with Sections 11B-404.2.7, 11B-404.2.8, 11B-404.2.9, 11B-404.3.2 and 11B-404.3.4 through 11B-404.3.7. A sign visible from the approach side complying with Section 11B-703.5 shall be posted stating "Entry restricted and controlled by security personnel".
2. At detention and correctional facilities, doors, doorways, and gates designed to be operated only by security personnel shall not be required to comply with Sections 11B-404.2.7, 11B-404.2.8, 11B-404.2.9, 11B-404.3.2 and 11B-404.3.4 through 11B-404.3.7.

**11B-404.2 Manual doors, doorways, and manual gates** Manual doors and doorways and manual gates intended for user passage shall comply with Section 11B-404.2.

**11B-404.2.1 Revolving doors, gates, and turnstiles.** Revolving doors, revolving gates, and turnstiles shall not be part of an accessible route.

**11B-404.2.2 Double-leaf doors and gates.** At least one of the active leaves of doorways with two leaves shall comply with Sections 11B-404.2.3 and 11B-404.2.4.

**11B-404.2.3 Clear width.** Door openings shall provide a clear width of 32 inches (813 mm) minimum. Clear open-

ings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm).

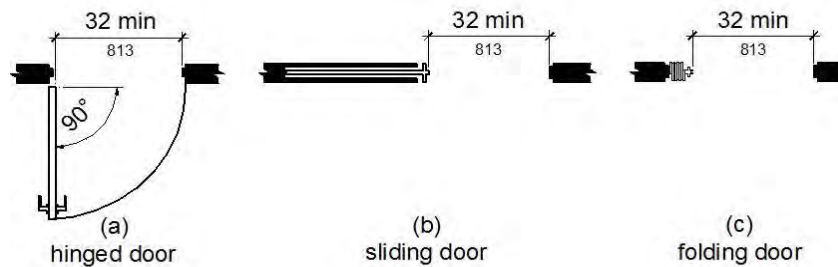
**Exceptions:**

1. In alterations, a projection of  $\frac{5}{8}$  inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
2. Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.
3. Doors, doorways, and gates not providing full user passage shall provide a clear width of 20 inches (510 mm) minimum.

**11B-404.2.4 Maneuvering clearances.** Minimum maneuvering clearances at doors and gates shall comply with Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance.

**Exception: Reserved.**

**11B-404.2.4.1 Swinging doors and gates.** Swinging doors and gates shall have maneuvering clearances complying with Table 11B-404.2.4.1.



**FIGURE 11B-404.2.3**  
**CLEAR WIDTH OF DOORWAYS**

**TABLE 11B-404.2.4.1**  
**MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES**

TYPE OF USE		MINIMUM MANEUVERING CLEARANCE	
Approach direction	Door or gate side	Perpendicular to doorway	Parallel to doorway (beyond latch side unless noted)
From front	Pull	60 inches (1524 mm)	18 inches (457 mm) <sup>5</sup>
From front	Push	48 inches (1219 mm)	0 inches (0 mm) <sup>1</sup>
From hinge side	Pull	60 inches (1524 mm)	36 inches (914 mm)
From hinge side	Push	44 inches (1118 mm) <sup>2</sup>	22 inches (559 mm) <sup>3</sup>
From latch side	Pull	60 inches (1524 mm)	24 inches (610 mm)
From latch side	Push	44 inches (1118 mm) <sup>4</sup>	24 inches (610 mm)

1. Add 12 inches (305 mm) if closer and latch are provided.
2. Add 4 inches (102 mm) if closer and latch are provided.
3. Beyond hinge side.
4. Add 4 inches (102 mm) if closer is provided.
5. Add 6 inches (152 mm) at exterior side of exterior doors.

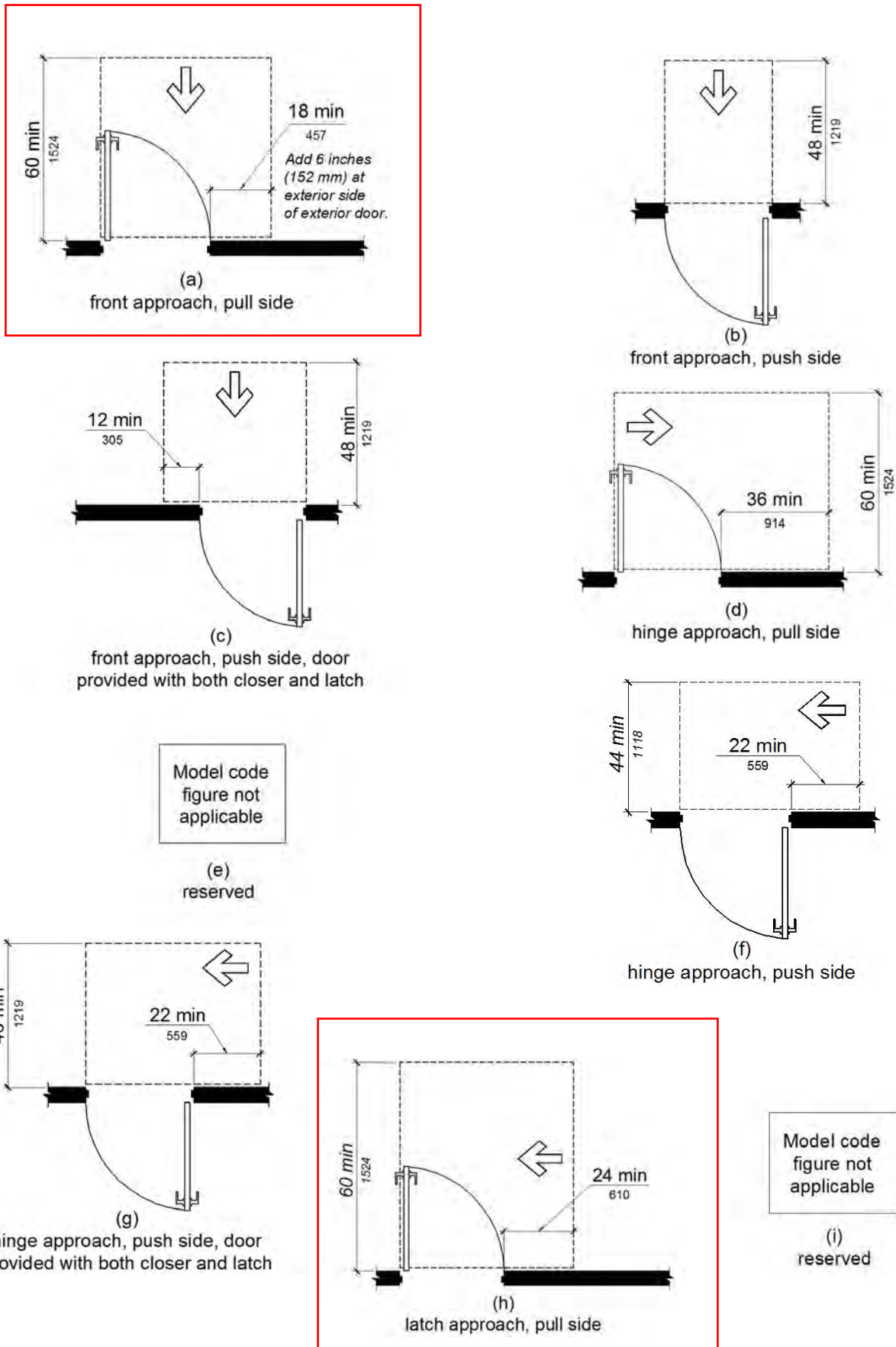


FIGURE 11B-404.2.4.1  
MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES

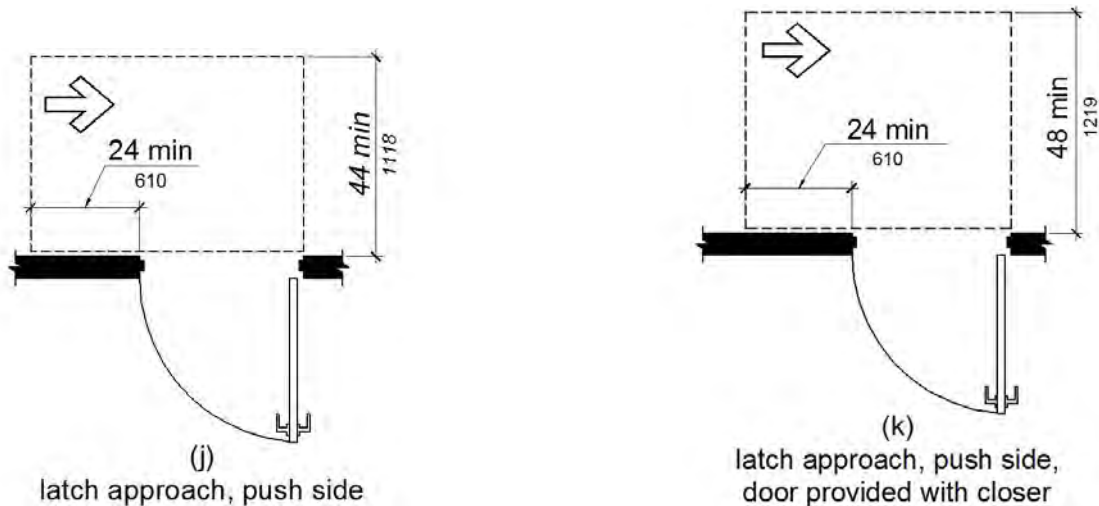


FIGURE 11B-404.2.4.1—continued  
MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES

**11B-404.2.4.2 Doorways without doors or gates, sliding doors, and folding doors.** Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors, or folding doors shall have maneuvering clearances complying with Table 11B-404.2.4.2.

**11B-404.2.4.3 Recessed doors and gates.** Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side at an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door, measured perpendicular to the face of the door or gate.

**11B-404.2.4.4 Floor or ground surface.** Floor or ground surface within required maneuvering clearances shall comply with Section 11B-302. Changes in level are not permitted.

**Exceptions:**

1. Slopes not steeper than 1:48 shall be permitted.
2. Changes in level at thresholds complying with Section 11B-404.2.5 shall be permitted.

**11B-404.2.5 Thresholds.** Thresholds, if provided at doorways, shall be  $\frac{1}{2}$  inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with Sections 11B-302 and 11B-303.

**Exception: Reserved.**

**11B-404.2.6 Doors in series and gates in series.** The distance between two hinged or pivoted doors in series and gates in series shall be 48 inches (1219 mm) minimum plus the width of doors or gates swinging into the space.

**11B-404.2.7 Door and gate hardware.** Handles, pulls, latches, locks, and other operable parts on doors and gates

shall comply with Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.

**Exceptions:**

1. Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles, and similar existing doors or grilles that are designed with locks that are activated only at the top or bottom rail.
2. Access gates in barrier walls and fences protecting pools, spas, and hot tubs shall be permitted to have operable parts of the release of latch on self-latching devices at 54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener, or integral combination lock.

**11B-404.2.8 Closing speed.** Door and gate closing speed shall comply with Section 11B-404.2.8.

**11B-404.2.8.1 Door closers and gate closers.** Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

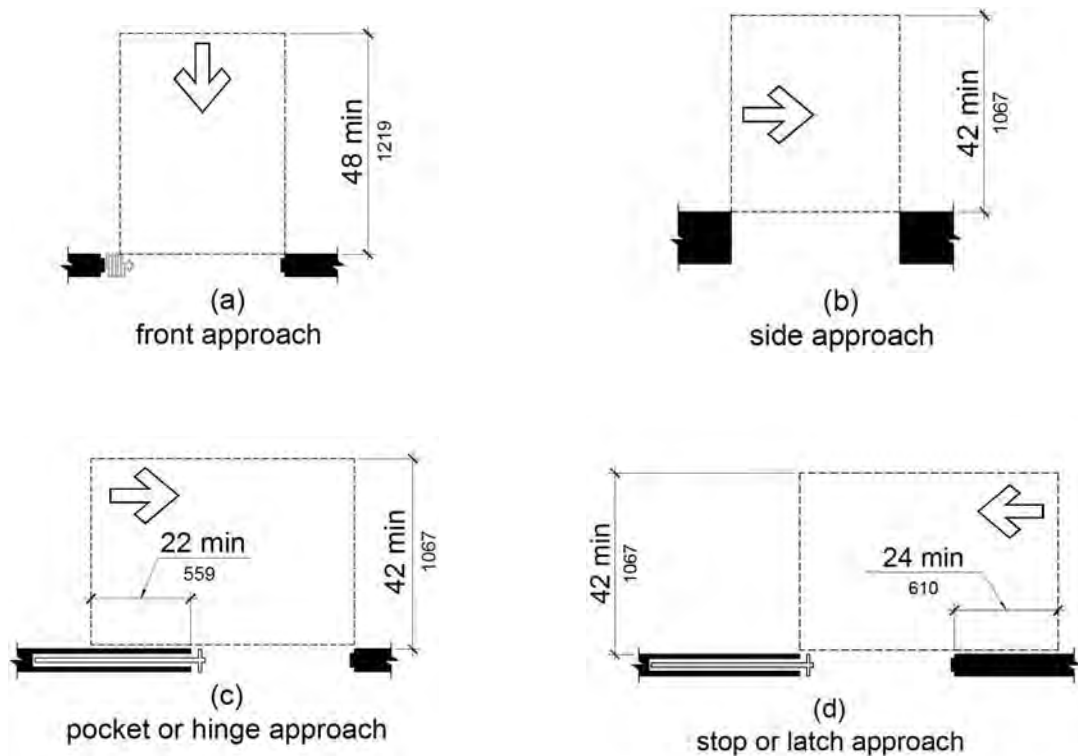
**11B-404.2.8.2 Spring hinges.** Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum.

**TABLE 11B-404.2.4.2**  
**MANEUVERING CLEARANCES AT DOORWAYS WITHOUT DOORS OR**  
**GATES, MANUAL SLIDING DOORS, AND MANUAL FOLDING DOORS**

Approach direction	MINIMUM MANEUVERING CLEARANCE	
	Perpendicular to doorway	Parallel to doorway (beyond stop/latch side unless noted)
From Front	48 inches (1219 mm)	0 inches (0 mm)
From side <sup>1</sup>	42 inches (1067 mm)	0 inches (0 mm)
From pocket/hinge side	42 inches (1067 mm)	22 inches (559 mm) <sup>2</sup>
From stop/latch side	42 inches (1067 mm)	24 inches (610 mm)

1. Doorway with no door only.

2. Beyond pocket/hinge side.



**FIGURE 11B-404.2.4.2**  
**MANEUVERING CLEARANCES AT DOORWAYS WITHOUT DOORS, SLIDING DOORS, GATES, AND FOLDING DOORS**



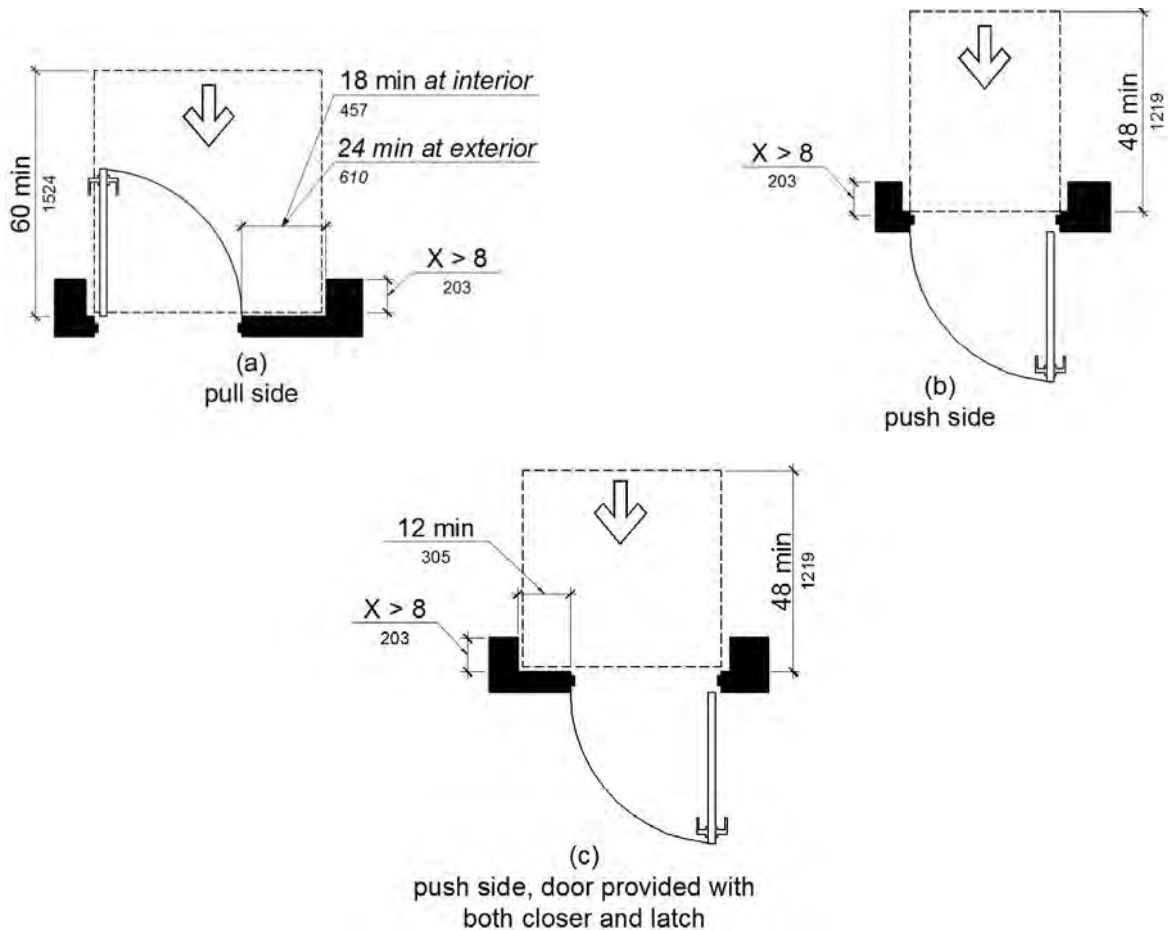


FIGURE 11B-404.2.4.3  
MANEUVERING CLEARANCES AT RECESSED DOORS AND GATES

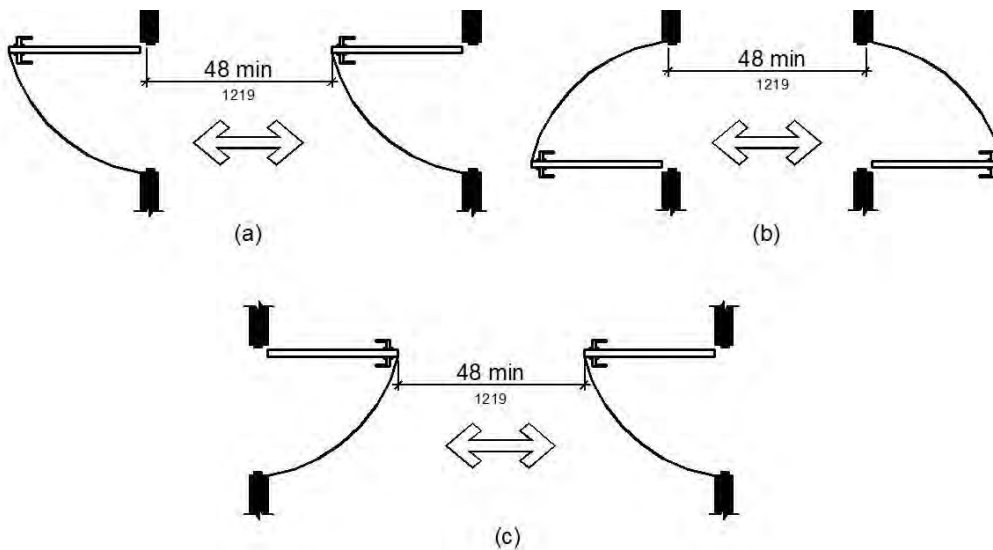


FIGURE 11B-404.2.6  
DOORS IN SERIES AND GATES IN SERIES



**11B-404.2.9 Door and gate opening force.** The force for pushing or pulling open a door or gate other than fire doors shall be as follows:

1. Interior hinged doors and gates: 5 pounds (22.2 N) maximum.
2. Sliding or folding doors: 5 pounds (22.2 N) maximum.
3. *Required fire doors: the minimum opening force allowable by the appropriate administrative authority, not to exceed 15 pounds (66.7 N).*
4. *Exterior hinged doors: 5 pounds (22.2 N) maximum.*

These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position.

**Exceptions:**

1. *Exterior doors to machinery spaces including, but not limited to, elevator pits or elevator penthouses; mechanical, electrical or communications equipment rooms; piping or equipment catwalks; electric substations and transformer vaults; and highway and tunnel utility facilities.*
2. *When, at a single location, one of every eight exterior door leafs, or fraction of eight, is a powered door, other exterior doors at the same location, serving the same interior space, may have a maximum opening force of 8.5 pounds (37.8 N). The powered leaf(s) shall be located closest to the accessible route.*
  - a. *Powered doors shall comply with Section 11B-404.3. Powered doors shall be fully automatic doors complying with Builders Hardware Manufacturers' Association (BHMA) A156.10 or low energy operated doors complying with BHMA A156.19.*
  - b. *Powered doors serving a building or facility with an occupancy of 150 or more shall be provided with a back-up battery or back-up generator. The back-up power source shall be able to cycle the door a minimum of 100 cycles.*
  - c. *Powered doors shall be controlled on both the interior and exterior sides of the doors by sensing devices, push plates, vertical actuation bars or other similar operating devices complying with Sections 11B-304, 11B-305 and 11B-308.*

*At each location where push plates are provided there shall be two push plates; the centerline of one push plate shall be 7 inches (178 mm) minimum and 8 inches (203 mm) maximum above the floor or ground surface and the centerline of the second push plate shall be 30 inches (762 mm) minimum and 44 inches (1118 mm) maximum above the floor or ground surface. Each push plate shall be a minimum*

*of 4 inches (102 mm) diameter or a minimum of 4 inches by 4 inches (102 mm by 102 mm) square and shall display the International Symbol of Accessibility complying with Section 11B-703.7.*

*At each location where vertical actuation bars are provided the operable portion shall be located so the bottom is 5 inches (127 mm) maximum above the floor or ground surface and the top is 35 inches (889 mm) minimum above the floor or ground surface. The operable portion of each vertical actuation bar shall be a minimum of 2 inches (51 mm) wide and shall display the International Symbol of Accessibility complying with Section 11B-703.7.*

*Where push plates, vertical actuation bars or other similar operating devices are provided, they shall be placed in a conspicuous location. A level and clear floor or ground space for forward or parallel approach complying with Section 11B-305 shall be provided, centered on the operating device. Doors shall not swing into the required clear floor or ground space.*

- d. *Signage identifying the accessible entrance required by Section 11B-216.6 shall be placed on, or immediately adjacent to, each powered door. Signage shall be provided in compliance with BHMA A156.10 or BHMA A156.19, as applicable.*
- e. *In addition to the requirements of Item d, where a powered door is provided in buildings or facilities containing assembly occupancies of 300 or more, a sign displaying the International Symbol of Accessibility measuring 6 inches by 6 inches (152 mm by 152 mm), complying with Section 11B-703.7, shall be provided above the door on both the interior and exterior sides of each powered door.*

**11B-404.2.10 Door and gate surfaces.** *Swinging door and gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within  $\frac{1}{16}$  inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped.*

**Exceptions:**

1. *Sliding doors shall not be required to comply with Section 11B-404.2.10.*
2. *Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizon-*

tal shall not be required to meet the 10 inch (254 mm) bottom smooth surface height requirement.

3. Doors and gates that do not extend to within 10 inches (254 mm) of the finish floor or ground shall not be required to comply with *Section 11B-404.2.10*.

4. **Reserved.**

**11B-404.2.11 Vision lights.** Doors, gates, and side lights adjacent to doors or gates, containing one or more glazing panels that permit viewing through the panels shall have the bottom of at least one glazed panel located 43 inches (1092 mm) maximum above the finish floor.

**Exception:** *Glazing panels* with the lowest part more than 66 inches (1676 mm) from the finish floor or ground shall not be required to comply with *Section 11B-404.2.11*.

**11B-404.3 Automatic and power-assisted doors and gates.**

Automatic doors and automatic gates shall comply with *Section 11B-404.3*. Full-powered automatic doors shall comply with ANSI/BHMA A156.10. Low-energy and power-assisted doors shall comply with ANSI/BHMA A156.19.

**11B-404.3.1 Clear width.** Doorways shall provide a clear opening of 32 inches (813 mm) minimum in power-on and power-off mode. The minimum clear width for automatic door systems in a doorway *shall provide a clear, unobstructed opening of 32 inches (813 mm) with one leaf positioned at an angle of 90 degrees from its closed position*.

**11B-404.3.2 Maneuvering clearance.** Clearances at power-assisted doors and gates shall comply with *Section 11B-404.2.4*. Clearances at automatic doors and gates without standby power and serving an accessible means of egress shall comply with *Section 11B-404.2.4*.

**Exception:** Where automatic doors and gates remain open in the power-off condition, compliance with *Section 11B-404.2.4* shall not be required.

**11B-404.3.3 Thresholds.** Thresholds and changes in level at doorways shall comply with *Section 11B-404.2.5*.

**11B-404.3.4 Doors in series and gates in series.** Doors in series and gates in series shall comply with *Section 11B-404.2.6*.

**11B-404.3.5 Controls.** Manually operated controls shall comply with *Section 11B-309*. The clear floor space adjacent to the control shall be located beyond the arc of the door swing.

**11B-404.3.6 Break out opening.** Where doors and gates without standby power are a part of a means of egress, the clear break out opening at swinging or sliding doors and gates shall be 32 inches (813 mm) minimum when operated in emergency mode.

**Exception:** Where manual swinging doors and gates comply with *Section 11B-404.2* and serve the same means of egress compliance with *Section 11B-404.3.6* shall not be required.

**11B-404.3.7 Revolving doors, revolving gates, and turnstiles.** Revolving doors, revolving gates, and turnstiles shall not be part of an accessible route.

**11B-405 Ramps**

**11B-405.1 General.** Ramps on accessible routes shall comply with *Section 11B-405*.

**Exception:** In assembly areas, aisle ramps adjacent to seating and not serving elements required to be on an accessible route shall not be required to comply with *Section 11B-405*.

**11B-405.2 Slope.** Ramp runs shall have a running slope not steeper than 1:12.

**Exception:** *Reserved.*

**11B-405.3 Cross slope.** Cross slope of ramp runs shall not be steeper than 1:48.

**11B-405.4 Floor or ground surfaces.** Floor or ground surfaces of ramp runs shall comply with *Section 11B-302*. Changes in level other than the running slope and cross slope are not permitted on ramp runs.

**11B-405.5 Clear width.** The clear width of a ramp run *shall be 48 inches (1219 mm) minimum*.

**Exceptions:**

1. Within employee work areas, the required clear width of ramps that are a part of common use circulation paths shall be permitted to be decreased by work area equipment provided that the decrease is essential to the function of the work being performed.
2. *Handrails may project into the required clear width of the ramp at each side 3 1/2 inches (89 mm) maximum at the handrail height.*
3. *The clear width of ramps in residential uses serving an occupant load of fifty or less shall be 36 inches (914 mm) minimum between handrails.*

**11B-405.6 Rise.** The rise for any ramp run shall be 30 inches (762 mm) maximum.

**11B-405.7 Landings.** Ramps shall have landings at the top and the bottom of each ramp run. Landings shall comply with *Section 11B-405.7*.

**11B-405.7.1 Slope.** Landings shall comply with *Section 11B-302*. Changes in level are not permitted.

**Exception:** Slopes not steeper than 1:48 shall be permitted.

**11B-405.7.2 Width.** The landing clear width shall be at least as wide as the widest ramp run leading to the landing.

**11B-405.7.2.1:** *Top landings shall be 60 inches (1524 mm) wide minimum.*

**11B-405.7.3 Length.** The landing clear length shall be 60 inches (1524 mm) long minimum.

**11B-405.7.3.1:** *Bottom landings shall extend 72 inches (1829 mm) minimum in the direction of ramp run.*

**11B-405.7.4 Change in direction.** Ramps that change direction between runs at landings shall have a clear landing 60 inches (1525 mm) minimum by 72 inches (1829 mm) minimum *in the direction of downward travel from the upper ramp run.*

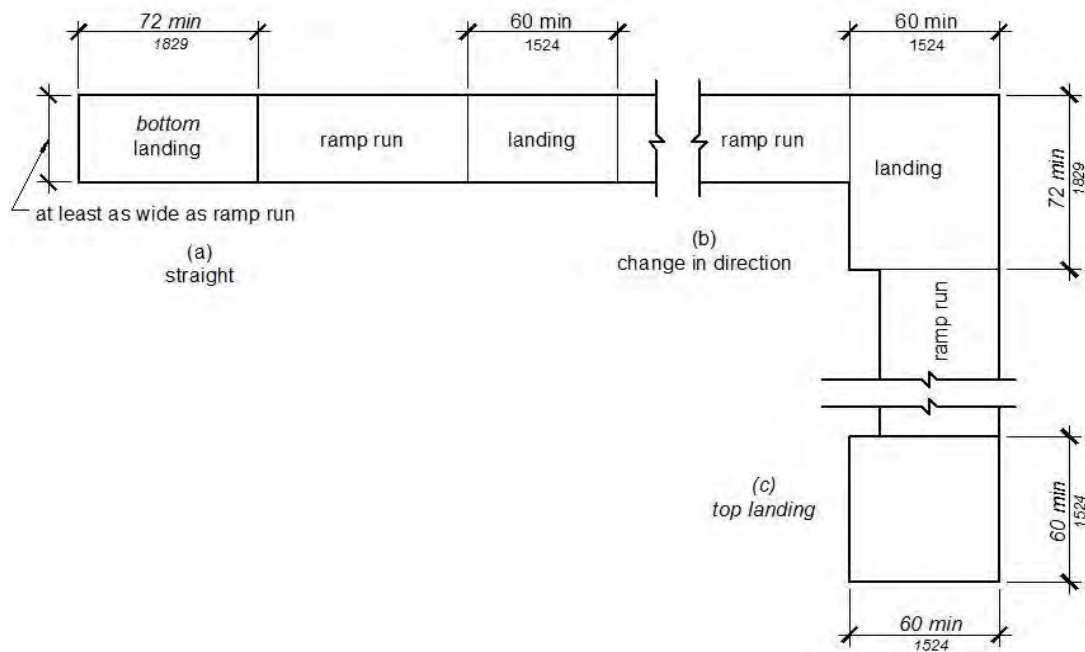


FIGURE 11B-405.7  
RAMP LANDINGS

**11B-405.7.5 Doorways.** Where doorways are located adjacent to a ramp landing, maneuvering clearances required by Sections 11B-404.2.4 and 11B-404.3.2 shall be permitted to overlap the required landing area. Doors, when fully open, shall not reduce the required ramp landing width by more than 3 inches (76 mm). Doors, in any position, shall not reduce the minimum dimension of the ramp landing to less than 42 inches (1067 mm).

**11B-405.8 Handrails.** Ramp runs shall have handrails complying with Section 11B-505.

**Exceptions:**

1. Reserved.
2. Handrails are not required at ramps immediately adjacent to fixed seating in assembly areas.
3. Curb ramps do not require handrails.
4. At door landings, handrails are not required on ramp runs less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

**11B-405.9 Edge protection.** Edge protection complying with Section 11B-405.9.2 shall be provided on each side of ramp runs and at each side of ramp landings.

**Exceptions:**

1. Edge protection shall not be required on ramps that are not required to have handrails and have sides complying with Section 11B-406.2.2.
2. Edge protection shall not be required on the sides of ramp landings serving an adjoining ramp run or stairway.
3. Edge protection shall not be required on the sides of ramp landings having a vertical drop-off of  $\frac{1}{2}$  inch

(12.7 mm) maximum within 10 inches (254 mm) horizontally of the minimum landing area specified in Section 11B-405.7.

**11B-405.9.1 Reserved.**

**11B-405.9.2 Curb or barrier.** A curb, 2 inches (51 mm) high minimum, or barrier shall be provided that prevents the passage of a 4 inch (102 mm) diameter sphere, where any portion of the sphere is within 4 inches (102 mm) of the finish floor or ground surface. To prevent wheel entrapment, the curb or barrier shall provide a continuous and uninterrupted barrier along the length of the ramp.

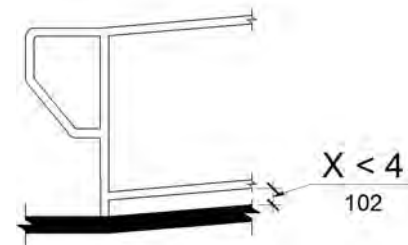


FIGURE 11B-405.9.2  
CURB OR BARRIER EDGE PROTECTION

**11B-405.10 Wet conditions.** Landings subject to wet conditions shall be designed to prevent the accumulation of water.

**11B-406 Curb ramps, blended transitions and islands**

**11B-406.1 General.** Curb ramps, blended transitions and islands on accessible routes shall comply with Section 11B-406. Curb ramps may be perpendicular, parallel, or a combination of perpendicular and parallel.

**11B-406.1.1 Perpendicular curb ramps.** Perpendicular curb ramps shall comply with Section 11B-406.2.

**11B-406.1.2 Parallel curb ramps.** Parallel curb ramps shall comply with Section 11B-406.3.

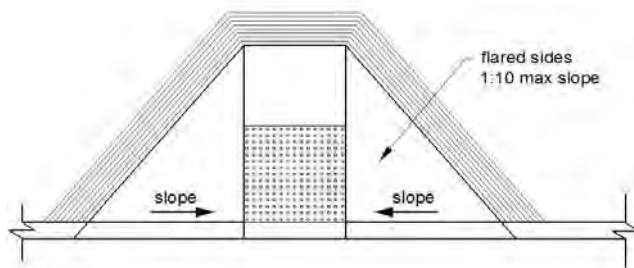
**11B-406.1.3 Blended transitions.** Blended transitions shall comply with Section 11B-406.4.

**11B-406.1.4 Islands.** Islands shall comply with Section 11B-406.6.

**11B-406.2 Perpendicular curb ramps.** Perpendicular curb ramps shall comply with Sections 11B-406.2 and 11B-406.5.

**11B-406.2.1 Slope.** Ramp runs shall have a running slope not steeper than 1:12.

**11B-406.2.2 Sides of curb ramps.** Where provided, curb ramp flares shall not be steeper than 1:10.

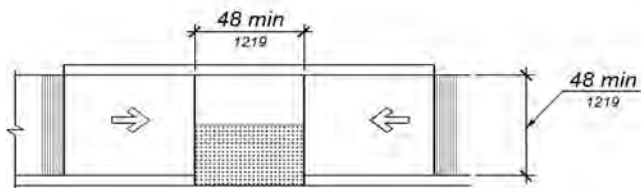


**FIGURE 11B-406.2.2  
SIDES OF CURB RAMPS**

**11B-406.3 Parallel curb ramps.** Parallel curb ramps shall comply with Sections 11B-406.3 and 11B-406.5.

**11B-406.3.1 Slope.** The running slope of the curb ramp segments shall be in-line with the direction of sidewalk travel. Ramp runs shall have a running slope not steeper than 1:12.

**11B-406.3.2 Turning space.** A turning space 48 inches (1219 mm) minimum by 48 inches (1219 mm) minimum shall be provided at the bottom of the curb ramp. The slope of the turning space in all directions shall be 1:48 maximum.



**FIGURE 11B-406.3.2  
PARALLEL CURB RAMPS**

**11B-406.4 Blended transitions.** Blended transitions shall comply with Sections 11B-406.4 and 11B-406.5.

**11B-406.4.1 Slope.** Blended transitions shall have a running slope not steeper than 1:20.

**11B-406.5 Common requirements.** Curb ramps and blended transitions shall comply with Section 11B-406.5.

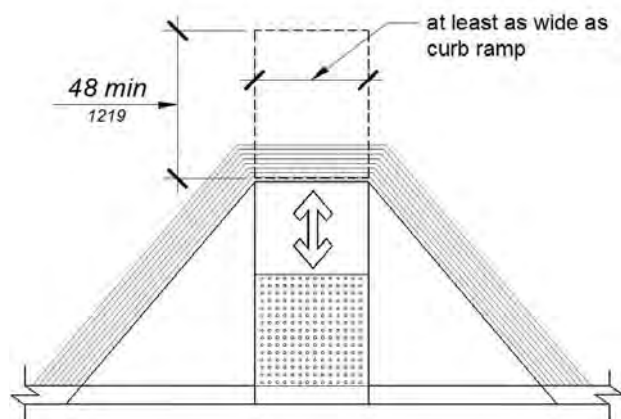
**11B-406.5.1 Location.** Curb ramps and the flared sides of curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces, or parking access aisles. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides.

**Exception:** Diagonal curb ramps shall comply with Section 11B-406.5.9.

**11B-406.5.2 Width.** The clear width of curb ramp runs (excluding any flared sides), blended transitions, and turning spaces shall be 48 inches (1219 mm) minimum.

**11B-406.5.3 Landings.** Landings shall be provided at the tops of curb ramps and blended transitions. The landing clear length shall be 48 inches (1219 mm) minimum. The landing clear width shall be at least as wide as the curb ramp, excluding any flared sides, or the blended transition leading to the landing. The slope of the landing in all directions shall be 1:48 maximum.

**Exception:** Parallel curb ramps shall not be required to comply with Section 11B-406.5.3.



**FIGURE 11B-406.5.3  
LANDINGS AT THE TOP OF CURB RAMPS**

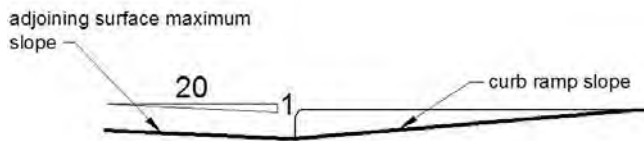
**11B-406.5.4 Floor or ground surfaces.** Floor or ground surfaces of curb ramps and blended transitions shall comply with Section 11B-405.4.

**11B-406.5.5 Wet conditions.** Curb ramps and blended transitions shall comply with Section 11B-405.10.

**11B-406.5.6 Grade breaks.** Grade breaks at the top and bottom of curb ramp runs shall be perpendicular to the direction of the ramp run. Grade breaks shall not be permitted on the surface of ramp runs and turning spaces. Surface slopes that meet at grade breaks shall be flush.

**11B-406.5.7 Cross slope.** The cross slope of curb ramps and blended transitions shall be 1:48 maximum.

**11B-406.5.8 Counter slope.** Counter slopes of adjoining gutters and road surfaces immediately adjacent to and within 24 inches (610 mm) of the curb ramp shall not be steeper than 1:20. The adjacent surfaces at transitions at curb ramps to walks, gutters, and streets shall be at the same level.



**FIGURE 11B-406.5.7**  
**COUNTER SLOPE OF SURFACES ADJACENT TO CURB RAMP**

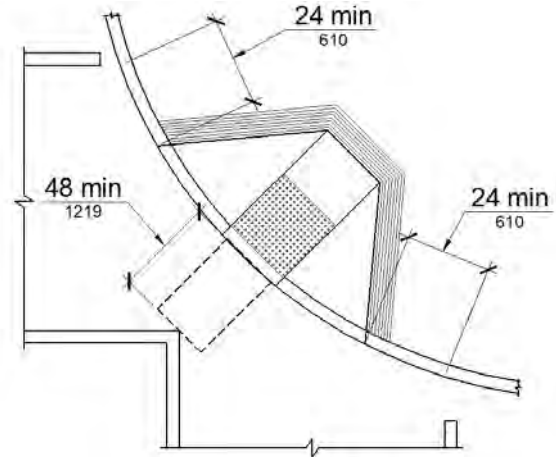
**11B-406.5.9 Clear space at diagonal curb ramps.** The bottom of diagonal curb ramps shall have a clear space 48 inches (1219 mm) minimum outside active traffic lanes of the roadway. Diagonal curb ramps provided at marked crossings shall provide the 48 inches (1219 mm) minimum clear space within the markings.

**11B-406.5.10 Diagonal curb ramps.** Diagonal or corner type curb ramps with returned curbs or other well-defined edges shall have the edges parallel to the direction of pedestrian flow. Diagonal curb ramps with flared sides shall have a segment of curb 24 inches (610 mm) long minimum located on each side of the curb ramp and within the marked crossing.

**11B-406.5.11 Grooved border.** Curb ramps shall have a grooved border 12 inches (305 mm) wide along the top of the curb ramp at the level surface of the top landing and at the outside edges of the flared sides. The grooved border shall consist of a series of grooves  $\frac{1}{4}$  inch (6.4 mm) wide by  $\frac{1}{4}$  inch (6.4 mm) deep, at  $\frac{3}{4}$  inch (19 mm) on center.

**Exceptions:**

1. At parallel curb ramps, the grooved border shall be on the upper approach immediately adjacent to the curb ramp across the full width of the curb ramp.
2. A grooved border shall not be required at blended transitions.



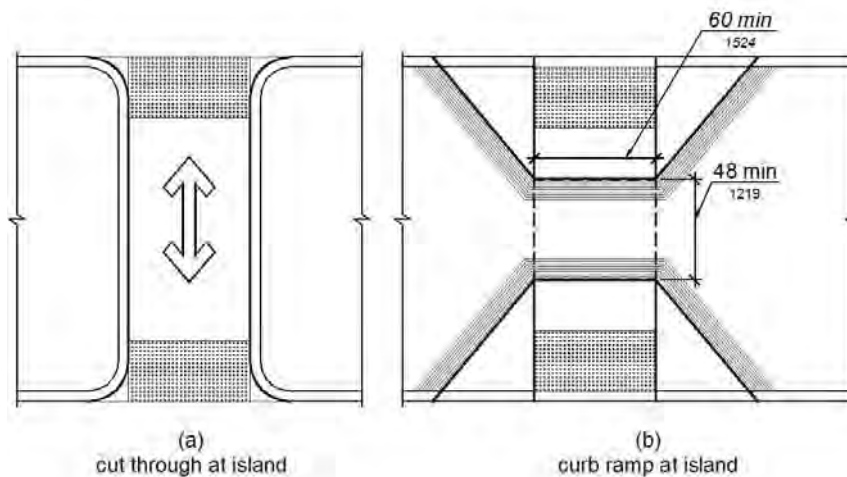
**FIGURE 11B-406.5.10**  
**DIAGONAL OR CORNER TYPE CURB RAMP**

**11B-406.5.12 Detectable warnings.** Curb ramps and blended transitions shall have detectable warnings complying with Section 11B-705.

**11B-406.6 Islands.** Raised islands in crossings shall be cut through level with the street or have curb ramps at both sides. The clear width of the accessible route at islands shall be 60 inches (1524 mm) wide minimum. Where curb ramps are provided, they shall comply with Section 11B-406. Landings complying with Section 11B-406.5.3 and the accessible route shall be permitted to overlap. Islands shall have detectable warnings complying with Section 11B-705.

**11B-407 Elevators**

**11B-407.1 General.** Elevators shall comply with Section 11B-407 and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.



**FIGURE 11B-406.6**  
**ISLANDS IN CROSSINGS**

**11B-407.1.1 Combined passenger and freight elevators.** When the only elevators provided for use by the public and employees are combination passenger and freight elevators, they shall comply with Section 11B-407 and with ASME A17.1.

**11B-407.2 Elevator landing requirements.** Elevator landings shall comply with Section 11B-407.2.

**11B-407.2.1 Call controls.** Where elevator call buttons or keypads are provided, they shall comply with Sections 11B-407.2.1 and 11B-309.4.

**Exception: Reserved.**

**11B-407.2.1.1 Height.** Call buttons and keypads shall be located within one of the reach ranges specified in Section 11B-308, measured to the centerline of the highest operable part.

**Exception: Reserved.**

**11B-407.2.1.2 Size and shape.** Call buttons shall have square shoulders, be  $\frac{3}{4}$  inch (19.1 mm) minimum in the smallest dimension and shall be raised  $\frac{1}{8}$  inch (3.2 mm) plus or minus  $\frac{1}{32}$  inch (0.8 mm) above the surrounding surface. The buttons shall be activated by a mechanical motion that is detectable.

**Exception: Reserved.**

**11B-407.2.1.3 Clear floor or ground space.** A clear floor or ground space complying with Section 11B-305 shall be provided at call controls.

**11B-407.2.1.4 Location.** The call button that designates the up direction shall be located above the call button that designates the down direction.

**Exception:** Destination-oriented elevators shall not be required to comply with Section 11B-407.2.1.4.

**11B-407.2.1.5 Signals.** Call buttons shall have visible signals that will activate when each call is registered and will extinguish when each call is answered. Call buttons shall be internally illuminated with a white light over the entire surface of the button.

**Exceptions:**

1. Destination-oriented elevators shall not be required to comply with Section 11B-407.2.1.5 provided that visible and audible signals complying with Section 11B-407.2.2 indicating which elevator car to enter are provided.

2. *Reserved.*

**11B-407.2.1.6 Keypads.** Where keypads are provided, keypads shall be in a standard telephone keypad arrangement and shall comply with Section 11B-407.4.7.2.

**11B-407.2.2 Hall signals.** Hall signals, including in-car signals, shall comply with Section 11B-407.2.2.

**11B-407.2.2.1 Visible and audible signals.** A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call and the car's direction of travel. Where in-car signals are

provided, they shall be visible from the floor area adjacent to the hall call buttons.

**Exceptions:**

1. Visible and audible signals shall not be required at each destination-oriented elevator where a visible and audible signal complying with Section 11B-407.2.2 is provided indicating the elevator car designation information.

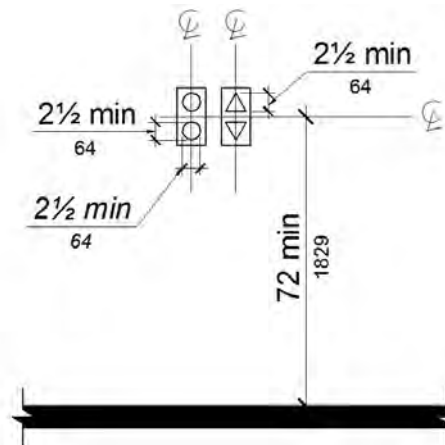
2. *Reserved.*

**11B-407.2.2.2 Visible signals.** Visible signal fixtures shall be centered at 72 inches (1829 mm) minimum above the finish floor or ground. The visible signal elements shall be a minimum  $2\frac{1}{2}$  inches (64 mm) high by  $2\frac{1}{2}$  inches (64 mm) wide. Signals shall be visible from the floor area adjacent to the hall call button.

**Exceptions:**

1. Destination-oriented elevators shall be permitted to have signals visible from the floor area adjacent to the hoistway entrance.

2. *Reserved.*



**FIGURE 11B-407.2.2.2  
VISIBLE HALL SIGNALS**

**11B-407.2.2.3 Audible signals.** Audible signals shall sound once for the up direction and twice for the down direction, or shall have verbal annunciators that indicate the direction of elevator car travel. Audible signals shall have a frequency of 1500 Hz maximum. Verbal annunciators shall have a frequency of 300 Hz minimum and 3000 Hz maximum. The audible signal and verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the hall call button.

**Exceptions:**

1. Destination-oriented elevators shall not be required to comply with Section 11B-407.2.2.3 provided that the audible tone and verbal announcement is the same as those given at the call button or call button keypad.

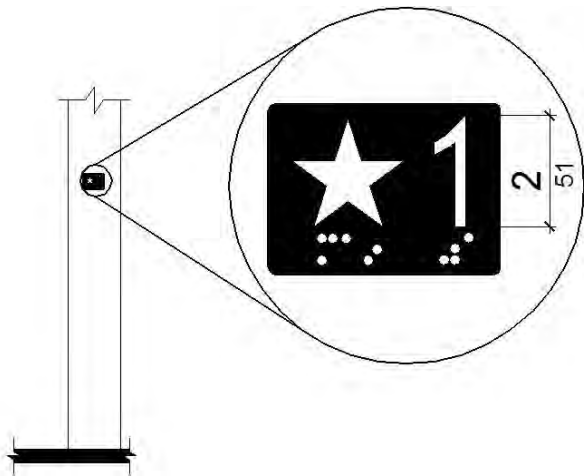
2. *Reserved.*



**11B-407.2.2.4 Differentiation.** Each destination-oriented elevator in a bank of elevators shall have audible and visible means for differentiation.

**11B-407.2.3 Hoistway signs.** Signs at elevator hoistways shall comply with Section 11B-407.2.3.

**11B-407.2.3.1 Floor designation.** Floor designations complying with Sections 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of elevator hoistway entrances. Floor designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches (51 mm) high. A raised star, placed to the left of the floor designation, shall be provided on both jambs at the main entry level. The outside diameter of the star shall be 2 inches (51 mm) and all points shall be of equal length. Raised characters, including the star, shall be white on a black background. Braille complying with Section 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be "MAIN". Applied plates are acceptable if they are permanently fixed to the jamb.



**FIGURE 11B-407.2.3.1  
FLOOR DESIGNATIONS ON JAMBS  
OF ELEVATOR HOISTWAY ENTRANCE**

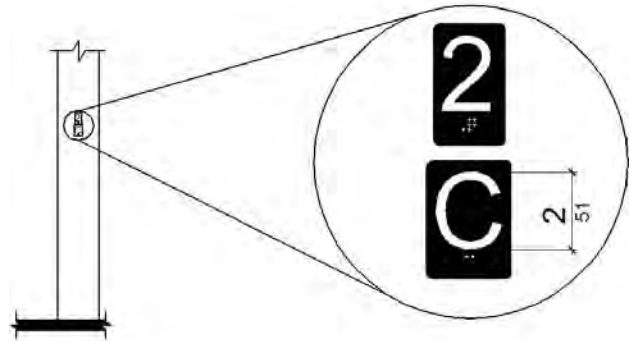
**11B-407.2.3.2 Car designations.** Destination-oriented elevators shall provide tactile car identification complying with Sections 11B-703.2 and 11B-703.4.1 on both jambs of the hoistway immediately below the floor designation. Car designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches (51 mm) high. Raised characters shall be white on a black background. Braille complying with Section 11B-703.3 shall be placed below the corresponding raised characters. Applied plates are acceptable if they are permanently fixed to the jamb.

**11B-407.3 Elevator door requirements.** Hoistway and car doors shall comply with Section 11B-407.3.

**11B-407.3.1 Type.** Elevator doors shall be the horizontal sliding type. Car gates shall be prohibited.

**11B-407.3.2 Operation.** Elevator hoistway and car doors shall open and close automatically.

**Exception:** Existing manually operated hoistway swing doors shall be permitted provided that they comply with Sections 11B-404.2.3 and 11B-404.2.9. Car door closing shall not be initiated until the hoistway door is closed.



**FIGURE 11B-407.2.3.2  
CAR DESIGNATIONS ON JAMBS OF  
DESTINATION-ORIENTED ELEVATOR HOISTWAY ENTRANCES**

**11B-407.3.3 Reopening device.** Elevator doors shall be provided with a reopening device complying with Section 11B-407.3.3 that shall stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person.

**Exception:** Existing elevators with manually operated doors shall not be required to comply with Section 11B-407.3.3.

**11B-407.3.3.1 Height.** The device shall be activated by sensing an obstruction passing through the opening at 5 inches (127 mm) nominal and 29 inches (737 mm) nominal above the finish floor.

**11B-407.3.3.2 Contact.** The device shall not require physical contact to be activated, although contact is permitted to occur before the door reverses.

**11B-407.3.3.3 Duration.** Door reopening devices shall remain effective for 20 seconds minimum.

**11B-407.3.4 Door and signal timing.** The minimum acceptable time from notification that a car is answering a call or notification of the car assigned at the means for the entry of destination information until the doors of that car start to close shall be calculated from the following equation:

$$T = D/(1.5 \text{ ft/s}) \text{ or } T = D/(455 \text{ mm/s}) = 5 \text{ seconds minimum}$$
 where  $T$  equals the total time in seconds and  $D$  equals the distance (in feet or millimeters) from the point in the lobby or corridor 60 inches (1524 mm) directly in front of the farthest call button controlling that car to the centerline of its hoistway door.

**Exceptions:**

1. For cars with in-car lanterns,  $T$  shall be permitted to begin when the signal is visible from the point

60 inches (1524 mm) directly in front of the farthest hall call button and the audible signal is sounded.

2. Destination-oriented elevators shall not be required to comply with Section 11B-407.3.4.

**11B-407.3.5 Door delay.** Elevator doors shall remain fully open in response to a car call for 5 seconds minimum.

**11B-407.3.6 Width.** The width of elevator doors shall comply with Table 11B-407.4.1.

**Exception:** In existing elevators, a power-operated car door complying with Section 11B-404.2.3 shall be permitted.

**11B-407.4 Elevator car requirements.** Elevator cars shall comply with Section 11B-407.4.

**11B-407.4.1 Car dimensions.** Inside dimensions of elevator cars and clear width of elevator doors shall comply with Table 11B-407.4.1.

**Exception:** In existing buildings, where existing shaft configuration or technical infeasibility prohibits strict compliance with Section 11B-407.4.1, existing elevator car configurations that provide a clear floor area of 18 square feet (1.67 m<sup>2</sup>) minimum and also provide an inside clear depth 54 inches (1372 mm) minimum and a clear width 48 inches (1219 mm) minimum shall be permitted.

**11B-407.4.2 Floor surfaces.** Floor surfaces in elevator cars shall comply with Sections 11B-302 and 11B-303.

**11B-407.4.3 Platform to hoistway clearance.** The clearance between the car platform sill and the edge of any hoistway landing shall be 1¼ inch (32 mm) maximum.

**11B-407.4.4 Leveling.** Each car shall be equipped with a self-leveling feature that will automatically bring and maintain the car at floor landings within a tolerance of ½ inch (12.7 mm) under rated loading to zero loading conditions.

**11B-407.4.5 Illumination.** The level of illumination at the car controls, platform, car threshold and car landing sill shall be 5 foot candles (54 lux) minimum.

**11B-407.4.6 Elevator car controls.** Where provided, elevator car controls shall comply with Sections 11B-407.4.6 and 11B-309.4.

**Exception:** In existing elevators, where a new car operating panel complying with Section 11B-407.4.6 is provided, existing car operating panels may remain operational and shall not be required to comply with Section 11B-407.4.6.

**11B-407.4.6.1 Location.** Controls shall be located within one of the reach ranges specified in Section 11B-308.

**Exceptions:**

1. Where the elevator panel serves more than 16 openings and a parallel approach is provided, buttons with floor designations shall be permitted to be 54 inches (1372 mm) maximum above the finish floor.
2. In existing elevators, car control buttons with floor designations shall be permitted to be located 54 inches (1372 mm) maximum above the finish floor where a parallel approach is provided.

**11B-407.4.6.2 Buttons.** Car control buttons with floor designations shall comply with Section 11B-407.4.6.2.

**Exception: Reserved.**

**11B-407.4.6.2.1 Size and shape.** Buttons shall have square shoulders, be ¾ inch (19.1 mm) minimum in their smallest dimension and be raised ⅛ inch (3.2 mm) plus or minus 1/32 inch (0.8 mm) above the surrounding surface.

**11B-407.4.6.2.2 Arrangement.** Buttons shall be arranged with numbers in ascending order. When two or more columns of buttons are provided they shall read from left to right.

**11B-407.4.6.2.3 Illumination.** Car control buttons shall be illuminated.

**11B-407.4.6.2.4 Operation.** Car control buttons shall be activated by a mechanical motion that is detectable.

**TABLE 11B-407.4.1  
ELEVATOR CAR DIMENSIONS**

DOOR LOCATION	MINIMUM DIMENSIONS			
	Door clear width	Inside car, side to side	Inside car, back wall to front return	Inside car, back wall to inside face of door
Centered	42 inches (1067 mm)	80 inches (2032 mm)	51 inches (1295 mm)	54 inches (1372 mm)
Side (off-centered)	36 inches (914 mm) <sup>1</sup>	68 inches (1727 mm)	51 inches (1295 mm)	54 inches (1372 mm)
Any	36 inches (914 mm) <sup>1</sup>	54 inches (1372 mm)	80 inches (2032 mm)	80 inches (2032 mm)
Any	36 inches (914 mm) <sup>2</sup>	60 inches (1524 mm) <sup>2</sup>	60 inches (1524 mm) <sup>2</sup>	60 inches (1524 mm) <sup>2</sup>

1. A tolerance of minus ⅜ inch (15.9 mm) is permitted.

2. Other car configurations that provide a turning space complying with Section 11B-304 with the door closed shall be permitted.



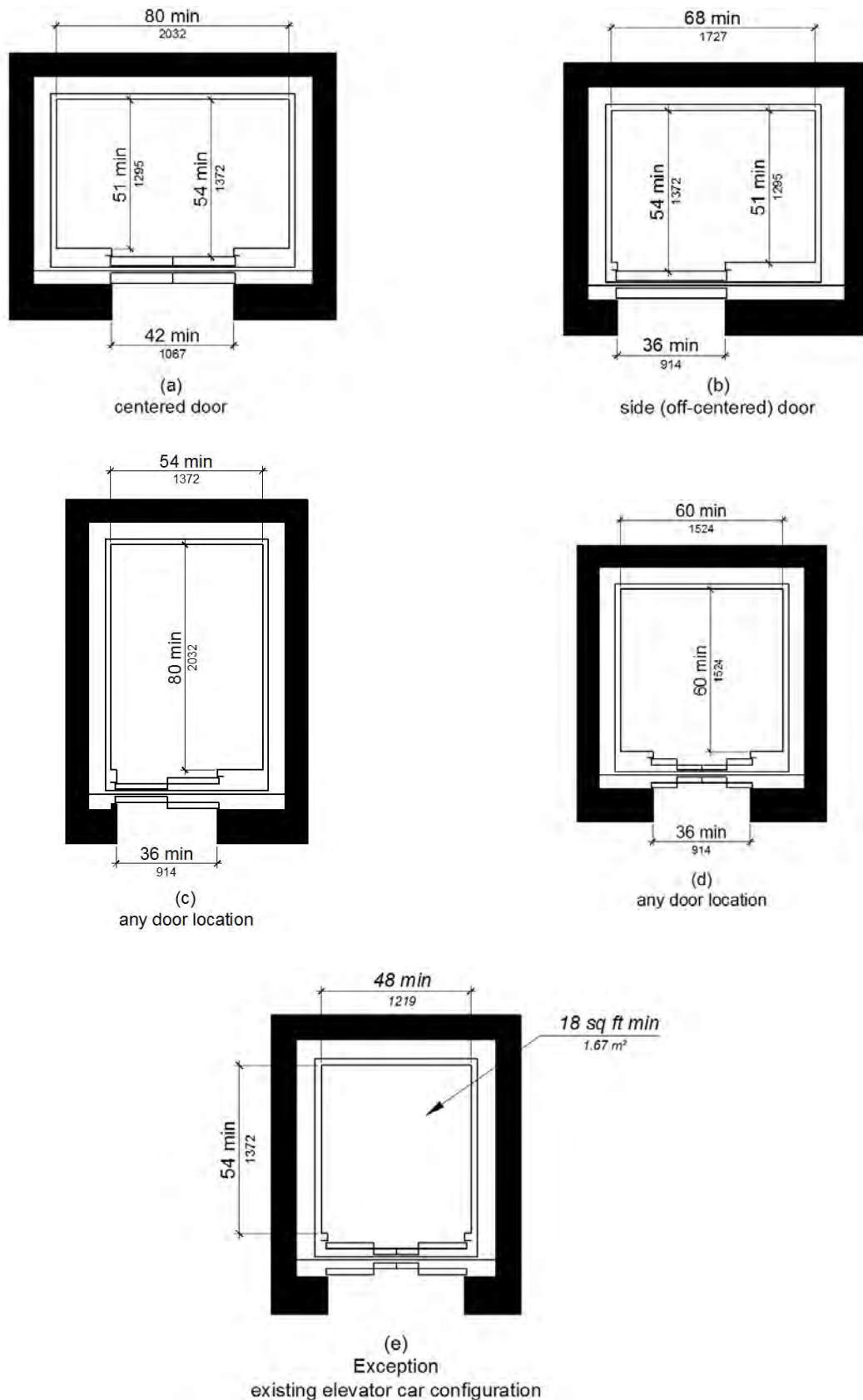


FIGURE 11B-407.4.1  
ELEVATOR CAR DIMENSIONS

**11B-407.4.6.3 Keypads.** Car control keypads shall be in a standard telephone keypad arrangement and shall comply with *Section 11B-407.4.7.2*.

**11B-407.4.6.4 Emergency controls.** Emergency controls shall comply with *Section 11B-407.4.6.4*.

**11B-407.4.6.4.1 Height.** Emergency control buttons shall have their centerlines 35 inches (889 mm) minimum above the finish floor.

**11B-407.4.6.4.2 Location.** Emergency controls, including the emergency alarm, shall be grouped at the bottom of the panel.

**11B-407.4.7 Designations and indicators of car controls.** Designations and indicators of car controls shall comply with *Section 11B-407.4.7*.

**Exception:** In existing elevators, where a new car operating panel complying with *Section 11B-407.4.7* is provided, existing car operating panels *may remain operational* and shall not be required to comply with *Section 11B-407.4.7*.

**11B-407.4.7.1 Buttons.** Car control buttons shall comply with *Section 11B-407.4.7.1*.

**11B-407.4.7.1.1 Type.** Control buttons shall be identified by *raised characters or symbols, white on a black background, complying with Section 11B-703.2 and Braille complying with Section 11B-703.3*.

**11B-407.4.7.1.2 Location.** Raised *characters or symbols* and Braille designations shall be placed immediately to the left of the control button to which the designations apply.

**11B-407.4.7.1.3 Symbols.** The control button for the emergency stop, alarm, door open, door close, main entry floor, and phone, shall be identified with *raised symbols and Braille* as shown in Table 11B-407.4.7.1.3.

**11B-407.4.7.1.4 Visible indicators.** Buttons with floor designations shall be provided with visible indicators to show that a call has been registered. The visible indication shall extinguish when the car arrives at the designated floor.

**11B-407.4.7.1.5 Button spacing.** *A minimum clear space of  $\frac{3}{8}$  inch (9.5 mm) or other suitable means of separation shall be provided between rows of control buttons.*

**11B-407.4.7.2 Keypads.** Keypads shall be identified by characters complying with *Section 11B-703.5* and shall be centered on the corresponding keypad button. The number five key shall have a single raised dot. The dot shall be 0.118 inch (3 mm) to 0.120 inch (3.05 mm) base diameter and in other aspects comply with Table 11B-703.3.1.

**11B-407.4.8 Car position indicators.** Audible and visible car position indicators shall be provided in elevator cars.

**11B-407.4.8.1 Visible indicators.** Visible indicators shall comply with *Section 11B-407.4.8.1*.

**11B-407.4.8.1.1 Size.** Characters shall be  $\frac{1}{2}$  inch (12.7 mm) high minimum.

**11B-407.4.8.1.2 Location.** Indicators shall be located above the car control panel or above the door.

**11B-407.4.8.1.3 Floor arrival.** As the car passes a floor and when a car stops at a floor served by the elevator, the corresponding character shall illuminate.

**Exception:** Destination-oriented elevators shall not be required to comply with *Section 11B-407.4.8.1.3* provided that the visible indicators extinguish when the call has been answered.













Control Button	Raised Symbol	Braille Message
Emergency Stop		 "ST"OP Three Cells
Alarm		 AL"AR"M Four Cells
Door Open		 OP"EN" Three Cells
Door Close		 CLOSE Five Cells
Main Entry Floor		 MA"IN" Three Cells
Phone		 PH"ONE" Four Cells

TABLE 11B-407.4.7.1.3  
ELEVATOR CONTROL BUTTON IDENTIFICATION

**11B-407.4.8.1.4 Destination indicator.** In destination-oriented elevators, a display shall be provided in the car with visible indicators to show car destinations.

**11B-407.4.8.2 Audible indicators.** Audible indicators shall comply with *Section 11B-407.4.8.2*.

**11B-407.4.8.2.1 Signal type.** The signal shall be an automatic verbal annunciator which announces the floor at which the car is about to stop.

**Exception:** For elevators other than destination-oriented elevators that have a rated speed of 200 feet per minute (1 m/s) or less, a non-verbal audible signal with a frequency of 1500 Hz maximum which sounds as the car passes or is about to stop at a floor served by the elevator shall be permitted.

**11B-407.4.8.2.2 Signal level.** The verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the annunciator.

**11B-407.4.8.2.3 Frequency.** The verbal annunciator shall have a frequency of 300 Hz minimum to 3000 Hz maximum.

**11B-407.4.9 Emergency communication.** Emergency two-way communication systems shall comply with *Section 11B-308*. Raised symbols or characters, white on a black background, and Braille shall be provided adjacent to the device and shall comply with *Sections 11B-703.2 and 11B-703.3*. Emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ASME A17.1.

**11B-407.4.10 Support rail.** Support rails shall be provided on at least one wall of the car.

**11B-407.4.10.1 Location.** Clearance between support rails and adjacent surfaces shall be 1½ inches (38 mm) minimum. Top of support rails shall be 31 inches (787 mm) minimum to 33 inches (838 mm) maximum above the floor of the car. The ends of the support rail shall be 6 inches (152 mm) maximum from adjacent walls.

**11B-407.4.10.2 Surfaces.** Support rails shall be smooth and any surface adjacent to them shall be free of sharp or abrasive elements.

**11B-407.4.10.3 Structural strength.** Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the support rail, fastener, mounting device, or supporting structure.

## **11B-408 Limited-use/limited-application elevators**

**11B-408.1 General.** Limited-use/limited-application elevators shall comply with *Section 11B-408* and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.

**11B-408.2 Elevator landings.** Landings serving limited-use/limited-application elevators shall comply with *Section 11B-408.2*.

**11B-408.2.1 Call buttons.** Elevator call buttons and keypads shall comply with *Section 11B-407.2.1*.

**11B-408.2.2 Hall signals.** Hall signals shall comply with *Section 11B-407.2.2*.

**11B-408.2.3 Hoistway signs.** Signs at elevator hoistways shall comply with *Section 11B-407.2.3.1*.

**11B-408.3 Elevator doors.** Elevator hoistway doors shall comply with *Section 11B-408.3*.

**11B-408.3.1 Sliding doors.** Sliding hoistway and car doors shall comply with *Sections 11B-407.3.1 through 11B-407.3.3 and 11B-408.4.1*.

**11B-408.3.2 Swinging doors.** Swinging hoistway doors shall open and close automatically and shall comply with *Sections 11B-404, 11B-407.3.2 and 11B-408.3.2*.

**11B-408.3.2.1 Power operation.** Swinging doors shall be power-operated and shall comply with ANSI/BHMA A156.19 (1997 or 2002 edition).

**11B-408.3.2.2 Duration.** Power-operated swinging doors shall remain open for 20 seconds minimum when activated.

**11B-408.4 Elevator cars.** Elevator cars shall comply with *11B-408.4*.

**11B-408.4.1 Car dimensions and doors.** Elevator cars shall provide a clear width 42 inches (1067 mm) minimum and a clear depth 54 inches (1372 mm) minimum. Car doors shall be positioned at the narrow ends of cars and shall provide 32 inches (813 mm) minimum clear width.

### **Exceptions:**

1. Cars that provide a clear width 51 inches (1295 mm) minimum shall be permitted to provide a clear depth 51 inches (1295 mm) minimum provided that car doors provide a clear opening 36 inches (914 mm) wide minimum.

### **2. Reserved.**

**11B-408.4.2 Floor surfaces.** Floor surfaces in elevator cars shall comply with *Sections 11B-302 and 11B-303*.

**11B-408.4.3 Platform to hoistway clearance.** The platform to hoistway clearance shall comply with *Section 11B-407.4.3*.

**11B-408.4.4 Leveling.** Elevator car leveling shall comply with *Section 11B-407.4.4*.

**11B-408.4.5 Illumination.** Elevator car illumination shall comply with *Section 11B-407.4.5*.

**11B-408.4.6 Car controls.** Elevator car controls shall comply with *Section 11B-407.4.6*. Control panels shall be centered on a side wall.

**11B-408.4.7 Designations and indicators of car controls.** Designations and indicators of car controls shall comply with *Section 11B-407.4.7*.

**11B-408.4.8 Emergency communications.** Car emergency signaling devices complying with *Section 11B-407.4.9* shall be provided.

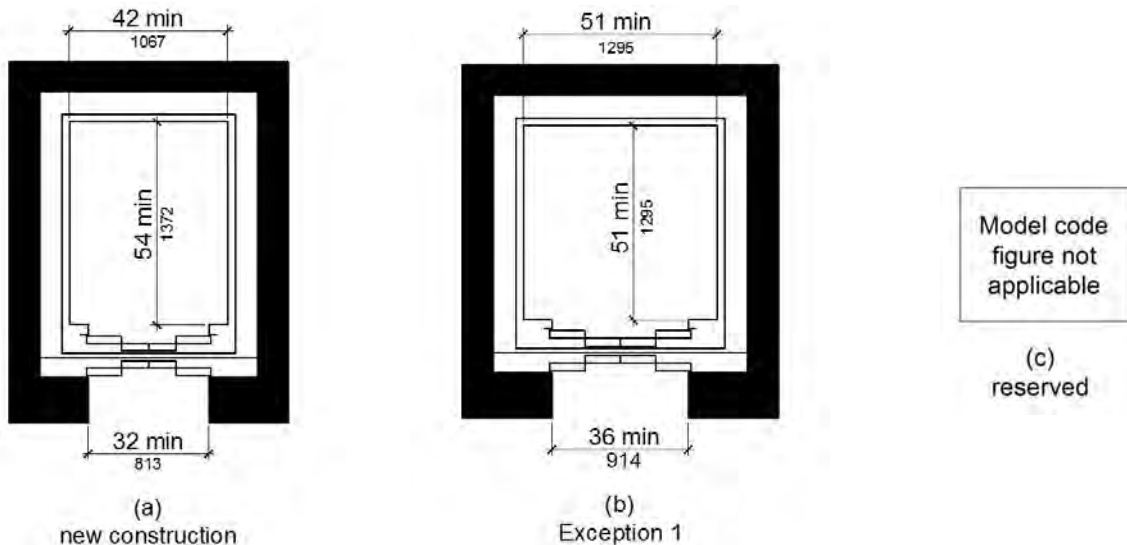


FIGURE 11B-408.4.1  
LIMITED-USE/LIMITED-APPLICATION (LULA) ELEVATOR CAR DIMENSIONS

#### 11B-409 Private residence elevators

**11B-409.1 General.** Private residence elevators that are provided within a residential dwelling unit required to provide mobility features complying with *Sections 11B-809.2 through 11B-809.4* shall comply with *Section 11B-409* and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.

**11B-409.2 Call buttons.** Call buttons shall be  $\frac{3}{4}$  inch (19.1 mm) minimum in the smallest dimension and shall comply with *Section 11B-309*.

**11B-409.3 Elevator doors.** Hoistway doors, car doors, and car gates shall comply with *Sections 11B-409.3* and *11B-404*.

**Exception:** Doors shall not be required to comply with the maneuvering clearance requirements in *Section 11B-404.2.4.1* for approaches to the push side of swinging doors.

**11B-409.3.1 Power operation.** Elevator car and hoistway doors and gates shall be power operated and shall comply with ANSI/BHMA A156.19. Power operated doors and gates shall remain open for 20 seconds minimum when activated.

**Exception:** In elevator cars with more than one opening, hoistway doors and gates shall be permitted to be of the manual-open, self-close type.

**11B-409.3.2 Location.** Elevator car doors or gates shall be positioned at the narrow end of the clear floor spaces required by *Section 11B-409.4.1*.

**11B-409.4 Elevator cars.** Private residence elevator cars shall comply with *Section 11B-409.4*.

**11B-409.4.1 Inside dimensions of elevator cars.** Elevator cars shall provide a clear floor space of 36 inches (914 mm) minimum by 48 inches (1219 mm) minimum and shall comply with *Section 11B-305*.

**11B-409.4.2 Floor surfaces.** Floor surfaces in elevator cars shall comply with *Sections 11B-302* and *11B-303*.

**11B-409.4.3 Platform to hoistway clearance.** The clearance between the car platform and the edge of any landing sill shall be  $1\frac{1}{2}$  inch (38 mm) maximum.

**11B-409.4.4 Leveling.** Each car shall automatically stop at a floor landing within a tolerance of  $\frac{1}{2}$  inch (12.7 mm) under rated loading to zero loading conditions.

**11B-409.4.5 Illumination levels.** Elevator car illumination shall comply with *Section 11B-407.4.5*.

**11B-409.4.6 Car controls.** Elevator car control buttons shall comply with *Sections 11B-409.4.6*, *11B-309.3*, *11B-309.4*, and shall be raised or flush.

**11B-409.4.6.1 Size.** Control buttons shall be  $\frac{3}{4}$  inch (19.1 mm) minimum in their smallest dimension.

**11B-409.4.6.2 Location.** Control panels shall be on a side wall, 12 inches (305 mm) minimum from any adjacent wall.

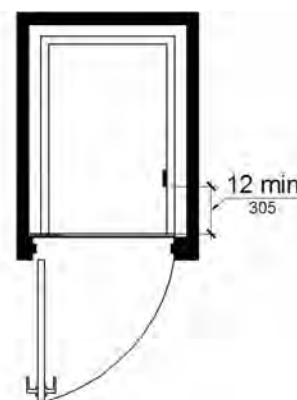


FIGURE 11B-409.4.6.2  
LOCATION OF PRIVATE RESIDENCE  
ELEVATOR CONTROL PANEL

**11B-409.4.7 Emergency communications.** Emergency two-way communication systems shall comply with *Section 11B-409.4.7*.

**11B-409.4.7.1 Type.** A telephone and emergency signal device shall be provided in the car.

**11B-409.4.7.2 Operable parts.** The telephone and emergency signaling device shall comply with *Sections 11B-309.3* and *11B-309.4*.

**11B-409.4.7.3 Compartment.** If the telephone or device is in a closed compartment, the compartment door hardware shall comply with *Section 11B-309*.

**11B-409.4.7.4 Cord.** The telephone cord shall be 29 inches (737 mm) long minimum.

#### **11B-410 Platform lifts**

**11B-410.1 General.** Platform lifts shall comply with ASME A18.1 (1999 edition or 2003 edition). Platform lifts shall not be attendant-operated and shall provide unassisted entry and exit from the lift.

**11B-410.2 Floor surfaces.** Floor surfaces in platform lifts shall comply with *Sections 11B-302* and *11B-303*.

**11B-410.3 Clear floor space.** Clear floor space in platform lifts shall comply with *Section 11B-305*.

**11B-410.4 Platform to runway clearance.** The clearance between the platform sill and the edge of any runway landing shall be 1 $\frac{1}{4}$  inch (32 mm) maximum.

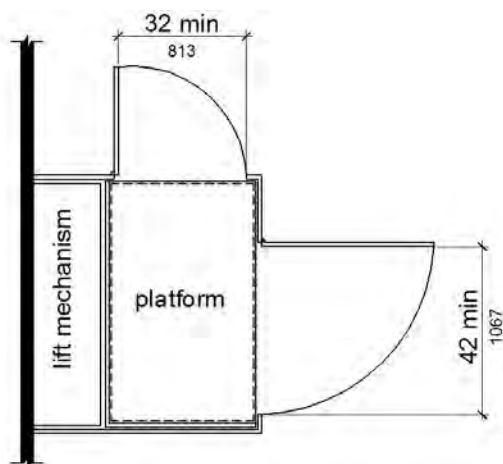
**11B-410.5 Operable parts.** Controls for platform lifts shall comply with *Section 11B-309*.

**11B-410.6 Doors and gates.** Platform lifts shall have low-energy power-operated doors or gates complying with *Section 11B-404.3*. Doors shall remain open for 20 seconds minimum. End doors and gates shall provide a clear width 32 inches (813 mm) minimum. Side doors and gates shall provide a clear width 42 inches (1067 mm) minimum.

**Exception:** Platform lifts serving two landings maximum and having doors or gates on opposite sides shall be permitted to have self-closing manual doors or gates.

**11B-410.7 Landing size.** The minimum size of landings at platform lifts shall be 60 inches by 60 inches (1524 mm by 1524 mm).

**11B-410.8 Restriction sign.** A sign complying with *Section 11B-703.5* shall be posted in a conspicuous place at each landing and within the platform enclosure stating "No Freight" and include the International Symbol of Accessibility complying with *Section 11B-703.7.2.1*.



**FIGURE 11B-410.6**  
**PLATFORM LIFT DOORS AND GATES**

## DIVISION 5: GENERAL SITE AND BUILDING ELEMENTS

### 11B-501 General

**11B-501.1 Scope.** The provisions of *Division 5* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-502 Parking spaces

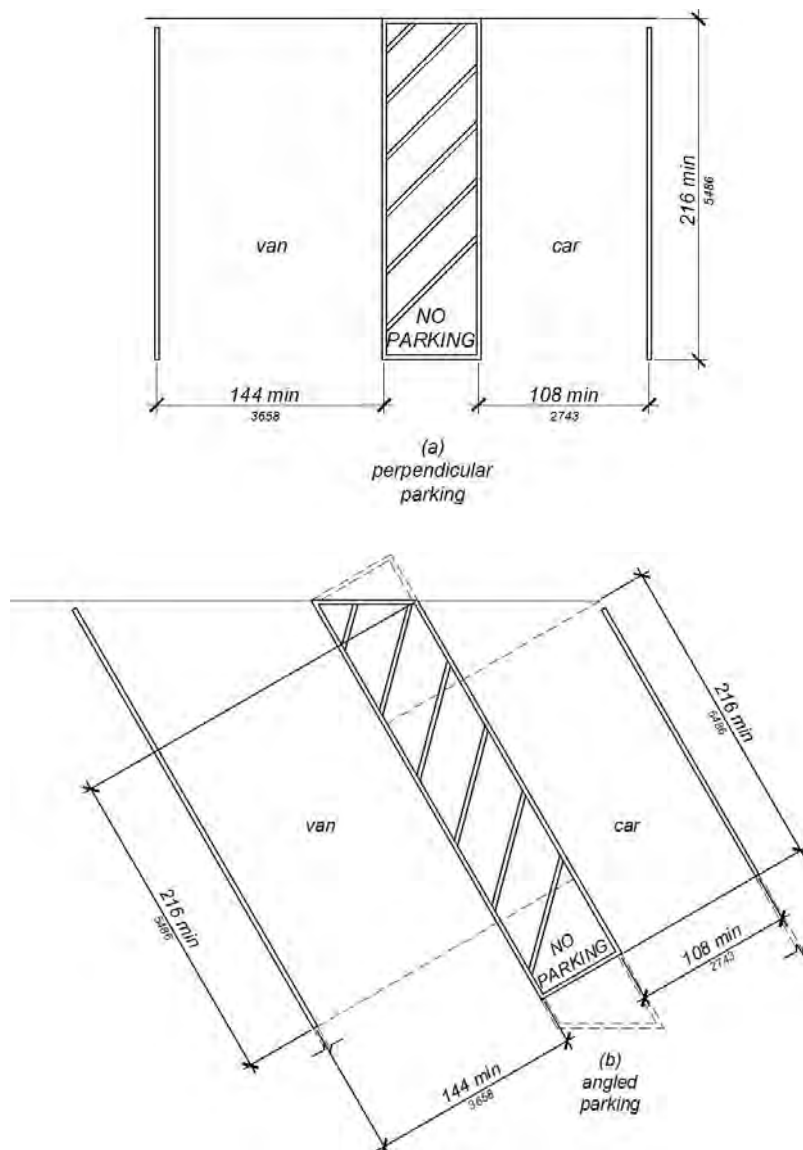
**11B-502.1 General.** Car and van parking spaces shall comply with *Section 11B-502*. Where parking spaces are marked with lines, width measurements of parking spaces and access aisles shall be made from the centerline of the markings.

**Exception:** Where parking spaces or access aisles are not adjacent to another parking space or access aisle, measure-

ments shall be permitted to include the full width of the line defining the parking space or access aisle.

**11B-502.2 Vehicle spaces.** Car and van parking spaces shall be 216 inches (5486 mm) long minimum. Car parking spaces shall be 108 inches (2743 mm) wide minimum and van parking spaces shall be 144 inches (3658 mm) wide minimum, shall be marked to define the width, and shall have an adjacent access aisle complying with *Section 11B-502.3*.

**Exception:** Van parking spaces shall be permitted to be 108 inches (2743 mm) wide minimum where the access aisle is 96 inches (2438 mm) wide minimum.



**FIGURE 11B-502.2  
VEHICLE PARKING SPACES**

**11B-502.3 Access aisle.** Access aisles serving parking spaces shall comply with Section 11B-502.3. Access aisles shall adjoin an accessible route. Two parking spaces shall be permitted to share a common access aisle.

**11B-502.3.1 Width.** Access aisles serving car and van parking spaces shall be 60 inches (1524 mm) wide minimum.

**11B-502.3.2 Length.** Access aisles shall extend the full required length of the parking spaces they serve.

**11B-502.3.3 Marking.** Access aisles shall be marked with a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with

hatched lines a maximum of 36 inches (914 mm) on center in a color contrasting with that of the aisle surface, preferably blue or white. The words "NO PARKING" shall be painted on the surface within each access aisle in white letters a minimum of 12 inches (305 mm) in height and located to be visible from the adjacent vehicular way. Access aisle markings may extend beyond the minimum required length.

**11B-502.3.4 Location.** Access aisles shall not overlap the vehicular way. Access aisles shall be permitted to be placed on either side of the parking space except for van parking spaces which shall have access aisles located on the passenger side of the parking spaces.

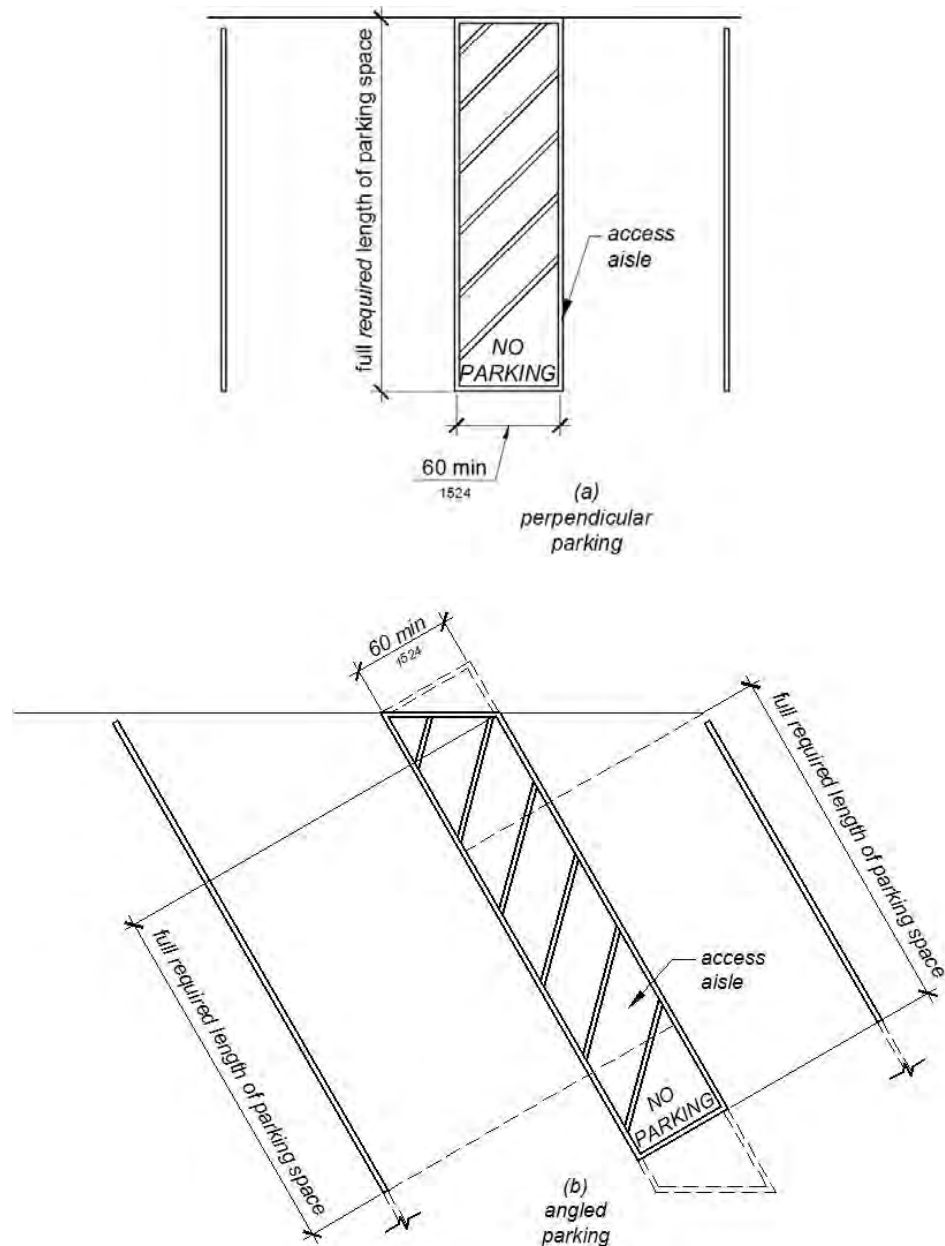
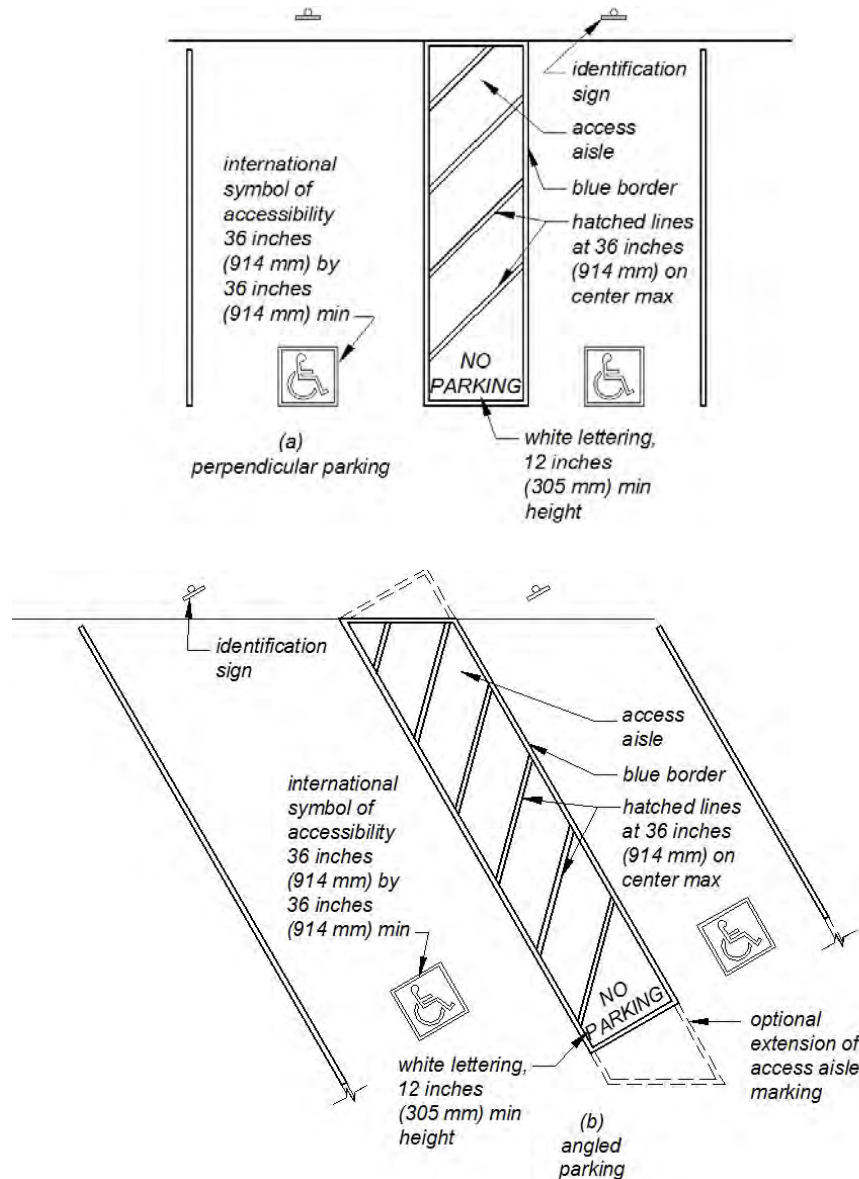


FIGURE 11B-502.3  
PARKING SPACE ACCESS AISLE





**FIGURE 11B-502.3.3**  
**ANGLED AND PERPENDICULAR PARKING IDENTIFICATION**

**11B-502.4 Floor or ground surfaces.** Parking spaces and access aisles serving them shall comply with *Section 11B-302*. Access aisles shall be at the same level as the parking spaces they serve. Changes in level are not permitted.

**Exception:** Slopes not steeper than 1:48 shall be permitted.

**11B-502.5 Vertical clearance.** Parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum.

**11B-502.6 Identification.** Parking space identification signs shall include the International Symbol of Accessibility complying with *Section 11B-703.7.2.1*. Signs identifying van parking spaces shall contain *additional language or an additional sign with the designation “van accessible.”* Signs shall

be 60 inches (1524 mm) minimum above the finish floor or ground surface measured to the bottom of the sign.

**Exception:** Signs located within an accessible route shall be a minimum of 80 inches (2032 mm) above the finish floor or ground surface measured to the bottom of the sign.

**11B-502.6.1 Finish and size.** Parking identification signs shall be reflectorized with a minimum area of 70 square inches (45,161 mm<sup>2</sup>).

**11B-502.6.2 Minimum fine.** Additional language or an additional sign below the International Symbol of Accessibility shall state “Minimum Fine \$250.”

**11B-502.6.3 Location.** A parking space identification sign shall be visible from each parking space. Signs shall be



permanently posted either immediately adjacent to the parking space or within the projected parking space width at the head end of the parking space. Signs may also be permanently posted on a wall at the interior end of the parking space.

**11B-502.6.4 Marking.** Each accessible car and van space shall have surface identification complying with either Sections 11B-502.6.4.1 or 11B-502.6.4.2.

**11B-502.6.4.1** The parking space shall be marked with an International Symbol of Accessibility complying with Section 11B-703.7.2.1 in white on a blue background a minimum 36 inches wide by 36 inches high (914 mm by 914 mm). The centerline of the International Symbol of Accessibility shall be a maximum of 6 inches (152 mm) from the centerline of the parking space, its sides parallel to the length of the parking space and its lower corner at, or lower side aligned with, the end of the parking space length.

**11B-502.6.4.2** The parking space shall be outlined or painted blue and shall be marked with an International Symbol of Accessibility complying with Section 11B-703.7.2.1 a minimum 36 inches wide by 36 inches high (914 mm by 914 mm) in white or a suitable contrasting color. The centerline of the International Symbol of Accessibility shall be a maximum of 6 inches (152 mm) from the centerline of the parking space, its sides parallel to the length of the parking space and its lower corner at, or lower side aligned with, the end of the parking space.

**11B-502.7 Relationship to accessible routes.** Parking spaces and access aisles shall be designed so that cars and vans, when parked, cannot obstruct the required clear width of adjacent accessible routes.

**11B-502.7.1 Arrangement.** Parking spaces and access aisles shall be designed so that persons using them are not required to travel behind parking spaces other than to pass behind the parking space in which they parked.

**11B-502.7.2 Wheel stops.** A curb or wheel stop shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.

**11B-502.8 Additional signage.** An additional sign shall be posted either; 1) in a conspicuous place at each entrance to an off-street parking facility or 2) immediately adjacent to on-site accessible parking and visible from each parking space.

**11B-502.8.1 Size.** The additional sign shall not be less than 17 inches (432 mm) wide by 22 inches (559 mm) high.

**11B-502.8.2 Lettering.** The additional sign shall clearly state in letters with a minimum height of 1 inch (25 mm) the following:

"Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at the owner's expense. Towed vehicles may

be reclaimed at: \_\_\_\_\_ or by telephoning \_\_\_\_\_."

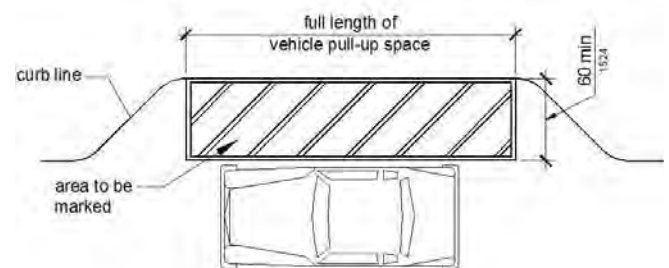
Blank spaces shall be filled in with appropriate information as a permanent part of the sign.

### **11B-503 Passenger drop-off and loading zones**

**11B-503.1 General.** Passenger drop-off and loading zones shall comply with Section 11B-503.

**11B-503.2 Vehicle pull-up space.** Passenger drop-off and loading zones shall provide a vehicular pull-up space 96 inches (2438 mm) wide minimum and 20 feet (6096 mm) long minimum.

**11B-503.3 Access aisle.** Passenger drop-off and loading zones shall provide access aisles complying with Section 11B-503 adjacent and parallel to the vehicle pull-up space. Access aisles shall adjoin an accessible route and shall not overlap the vehicular way.



**FIGURE 11B-503.3  
PASSENGER DROP-OFF AND LOADING ZONE ACCESS AISLE**

**11B-503.3.1 Width.** Access aisles serving vehicle pull-up spaces shall be 60 inches (1524 mm) wide minimum.

**11B-503.3.2 Length.** Access aisles shall extend the full length of the vehicle pull-up spaces they serve.

**11B-503.3.3 Marking.** Access aisles shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36 inches (914 mm) on center in a color contrasting with that of the aisle surface.

**11B-503.4 Floor and ground surfaces.** Vehicle pull-up spaces and access aisles serving them shall comply with Section 11B-302. Access aisles shall be at the same level as the vehicle pull-up space they serve. Changes in level are not permitted.

**Exception:** Slopes not steeper than 1:48 shall be permitted.

**11B-503.5 Vertical clearance.** Vehicle pull-up spaces, access aisles serving them, and a vehicular route from an entrance to the passenger loading zone and from the passenger loading zone to a vehicular exit shall provide a vertical clearance of 114 inches (2896 mm) minimum.

**11B-503.6 Identification.** Each passenger loading zone designated for persons with disabilities shall be identified with a reflectorized sign complying with Section 11B-703.5. It shall be permanently posted immediately adjacent to and visible from the passenger loading zone stating "Passenger Loading

Zone Only” and including the International Symbol of Accessibility complying with Section 11B-703.7.2.1 in white on a dark blue background.

#### 11B-504 Stairways

**11B-504.1 General.** Stairs shall comply with Section 11B-504.

**11B-504.2 Treads and risers.** All steps on a flight of stairs shall have uniform riser heights and uniform tread depths. Risers shall be 4 inches (102 mm) high minimum and 7 inches (178 mm) high maximum. Treads shall be 11 inches (279 mm) deep minimum.

**11B-504.3 Open risers.** Open risers are not permitted.

##### Exceptions:

1. On exterior stairways, an opening of not more than  $\frac{1}{2}$  inch (12.7 mm) may be permitted between the base of the riser and the tread.
2. On exterior stairways, risers constructed of grating containing openings of not more than  $\frac{1}{2}$  inch (12.7 mm) may be permitted.

**11B-504.4 Tread surface.** Stair treads shall comply with Section 11B-302. Changes in level are not permitted.

**Exception:** Treads shall be permitted to have a slope not steeper than 1:48.

**11B-504.4.1 Contrasting stripe.** Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast. Exterior stairs shall have the upper approach and all treads marked by a stripe providing clear visual contrast.

The stripe shall be a minimum of 2 inches (51 mm) wide to a maximum of 4 inches (102 mm) wide placed parallel to, and not more than 1 inch (25 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.

**11B-504.5 Nosings.** The radius of curvature at the leading edge of the tread shall be  $\frac{1}{2}$  inch (12.7 mm) maximum. Nosings that project beyond risers shall have the underside of the leading edge curved or beveled. Risers shall be permitted to slope under the tread at an angle of 30 degrees maximum from vertical. The permitted projection of the nosing shall extend  $1\frac{1}{4}$  inches (32 mm) maximum over the tread below.

**Exception:** In existing buildings there is no requirement to retroactively alter existing nosing projections of  $1\frac{1}{2}$  inches (38 mm) which were constructed in compliance with the building code in effect at the time of original construction.

**11B-504.6 Handrails.** Stairs shall have handrails complying with Section 11B-505.

**11B-504.7 Wet conditions.** Stair treads and landings subject to wet conditions shall be designed to prevent the accumulation of water.

**11B-504.8 Floor identification.** Floor identification signs required by Chapter 10, Section 1022.9 complying with Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5 shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters.

#### 11B-505 Handrails

**11B-505.1 General.** Handrails provided along walking surfaces complying with Section 11B-403, required at ramps complying with Section 11B-405, and required at stairs complying with Section 11B-504 shall comply with Section 11B-505.

**11B-505.2 Where required.** Handrails shall be provided on both sides of stairs and ramps.

##### Exceptions:

1. In assembly areas, handrails shall not be required on both sides of aisle ramps where a handrail is provided at either side or within the aisle width.
2. Curb ramps do not require handrails.
3. At door landings, handrails are not required when the ramp run is less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

**11B-505.3 Continuity.** Handrails shall be continuous within the full length of each stair flight or ramp run. Inside handrails on switchback or dogleg stairs and ramps shall be continuous between flights or runs.

**Exception:** In assembly areas, ramp handrails adjacent to seating or within the aisle width shall not be required to be continuous in aisles serving seating.

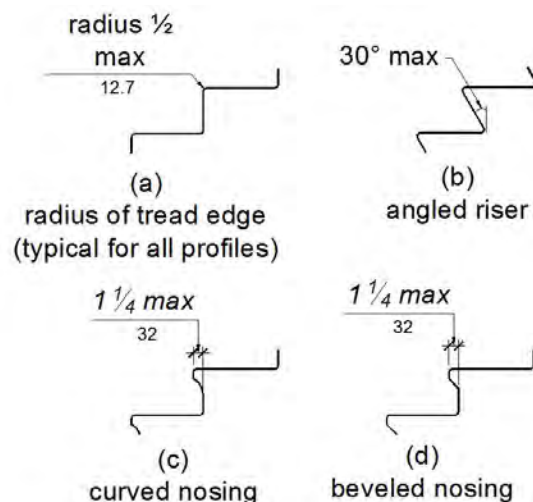
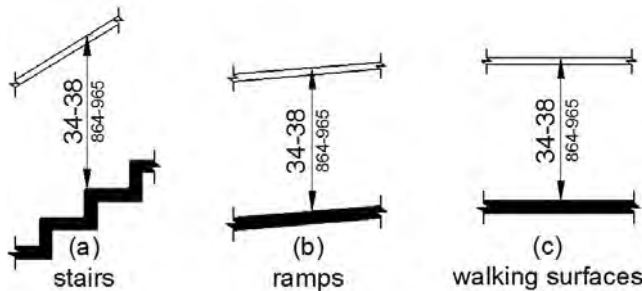


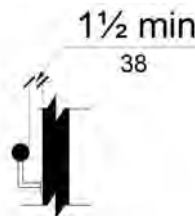
FIGURE 11B-504.5  
STAIR NOSINGS

**11B-505.4 Height.** Top of gripping surfaces of handrails shall be 34 inches (864 mm) minimum and 38 inches (965 mm) maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above walking surfaces, stair nosings, and ramp surfaces.



**FIGURE 11B-505.4  
HANDRAIL HEIGHT**

**11B-505.5 Clearance.** Clearance between handrail gripping surfaces and adjacent surfaces shall be  $1\frac{1}{2}$  inches (38 mm) minimum. Handrails may be located in a recess if the recess is 3 inches (76 mm) maximum deep and 18 inches (457 mm) minimum clear above the top of the handrail.

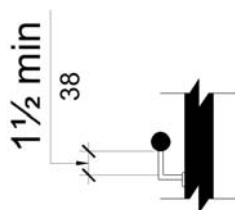


**FIGURE 11B-505.5  
HANDRAIL CLEARANCE**

**11B-505.6 Gripping surface.** Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur  $1\frac{1}{2}$  inches (38 mm) minimum below the bottom of the handrail gripping surface.

**Exceptions:**

1. Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of handrail gripping surfaces shall be permitted to be



**FIGURE 11B-505.6  
HORIZONTAL PROJECTIONS BELOW GRIPPING SURFACE**

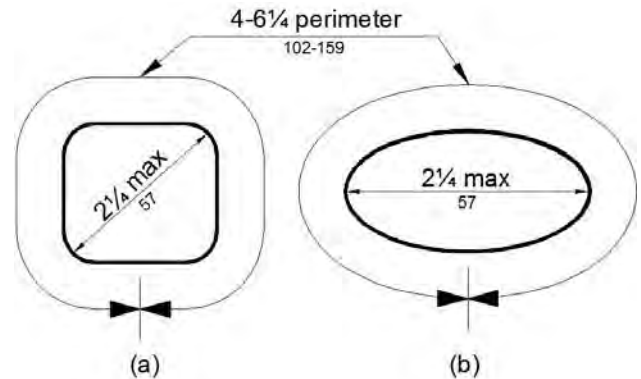
obstructed along their entire length where they are integral to crash rails or bumper guards.

2. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by  $\frac{1}{8}$  inch (3.2 mm) for each  $\frac{1}{2}$  inch (12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

**11B-505.7 Cross section.** Handrail gripping surfaces shall have a cross section complying with Section 11B-505.7.1 or 11B-505.7.2.

**11B-505.7.1 Circular cross section.** Handrail gripping surfaces with a circular cross section shall have an outside diameter of  $1\frac{1}{4}$  inches (32 mm) minimum and 2 inches (51 mm) maximum.

**11B-505.7.2 Non-circular cross sections.** Handrail gripping surfaces with a non-circular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and  $6\frac{1}{4}$  inches (159 mm) maximum, and a cross-section dimension of  $2\frac{1}{4}$  inches (57 mm) maximum.



**FIGURE 11B-505.7.2  
HANDRAIL NON-CIRCULAR CROSS SECTION**

**11B-505.8 Surfaces.** Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.

**11B-505.9 Fittings.** Handrails shall not rotate within their fittings.

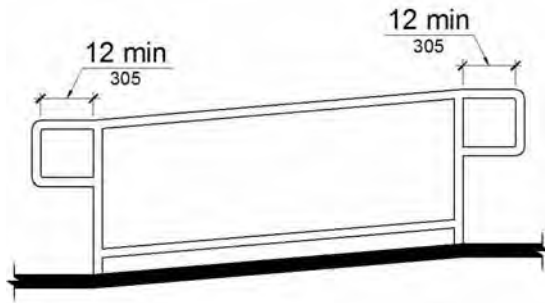
**11B-505.10 Handrail extensions.** Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with Section 11B-505.10.

**Exceptions:**

1. Extensions shall not be required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.
2. In assembly areas, extensions shall not be required for ramp handrails in aisles serving seating where the handrails are discontinuous to provide access to seating and to permit crossovers within aisles.
3. In alterations, where the extension of the handrail in the direction of ramp run would create a hazard, the extension of the handrail may be turned 90 degrees from the ramp run.

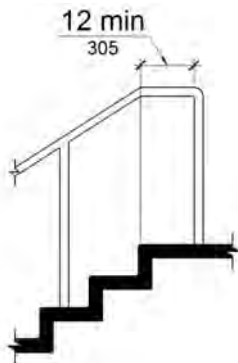
**11B-505.10.1 Top and bottom extension at ramps.**

Ramp handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent ramp run.



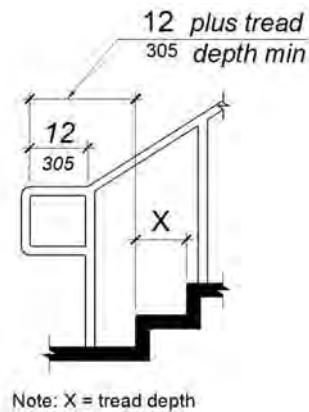
**FIGURE 11B-505.10.1**  
**TOP AND BOTTOM HANDRAIL EXTENSION AT RAMP**

**11B-505.10.2 Top extension at stairs.** At the top of a stair flight, handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beginning directly above the first riser nosing. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight.



**FIGURE 11B-505.10.2**  
**TOP HANDRAIL EXTENSION AT STAIRS**

**11B-505.10.3 Bottom extension at stairs.** At the bottom of a stair flight, handrails shall extend at the slope of the stair flight for a horizontal distance equal to one tread depth beyond the last riser nosing. Such extension shall continue with a horizontal extension or shall be continuous to the handrail of an adjacent stair flight or shall return to a wall, guard, or the walking surface. At the bottom of a stair flight, a horizontal extension of a handrail shall be 12 inches (305 mm) long minimum and a height equal to that of the sloping portion of the handrail as measured above the stair nosings. Extension shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight.



**FIGURE 11B-505.10.3**  
**BOTTOM HANDRAIL EXTENSION AT STAIRS**

## DIVISION 6: PLUMBING ELEMENTS AND FACILITIES

### 11B-601 General

**11B-601.1 Scope.** The provisions of *Division 6* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-602 Drinking fountains

**11B-602.1 General.** Drinking fountains shall comply with *Sections 11B-307* and *11B-602*.

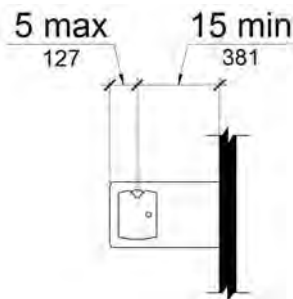
**11B-602.2 Clear floor space.** Units shall have a clear floor or ground space complying with *Section 11B-305* positioned for a forward approach and centered on the unit. Knee and toe clearance complying with *Section 11B-306* shall be provided.

**Exception:** A parallel approach complying with *Section 11B-305* shall be permitted at units for children's use where the spout is 30 inches (762 mm) maximum above the finish floor or ground and is 3½ inches (89 mm) maximum from the front edge of the unit, including bumpers.

**11B-602.3 Operable parts.** Operable parts shall comply with *Section 11B-309*. The flow of water shall be activated by a manually operated system that is front mounted or side mounted and located within 6 inches (152 mm) of the front edge of the fountain or an automatic electronically controlled device.

**11B-602.4 Spout height.** Spout outlets shall be 36 inches (914 mm) maximum above the finish floor or ground.

**11B-602.5 Spout location.** The spout shall be located 15 inches (381 mm) minimum from the vertical support and 5 inches (127 mm) maximum from the front edge of the unit,



**FIGURE 11B-602.5  
DRINKING FOUNTAIN SPOUT LOCATION**

including bumpers.

**11B-602.6 Water flow.** The spout shall provide a flow of water 4 inches (102 mm) high minimum and shall be located 5 inches (127 mm) maximum from the front of the unit. The angle of the water stream shall be measured horizontally relative to the front face of the unit. Where spouts are located less than 3 inches (76 mm) of the front of the unit, the angle of the water stream shall be 30 degrees maximum. Where spouts are

located between 3 inches (76 mm) and 5 inches (127 mm) maximum from the front of the unit, the angle of the water stream shall be 15 degrees maximum.

**11B-602.7 Drinking fountains for standing persons.** Spout outlets of drinking fountains for standing persons shall be 38 inches (965 mm) minimum and 43 inches (1092 mm) maximum above the finish floor or ground.

**11B-602.8 Depth.** Wall- and post-mounted cantilevered drinking fountains shall be 18 inches (457 mm) minimum and 19 inches (483 mm) maximum in depth.

**11B-602.9 Pedestrian protection.** All drinking fountains shall either be located completely within alcoves, positioned completely between wing walls, or otherwise positioned so as not to encroach into pedestrian ways. The protected area within which a drinking fountain is located shall be 32 inches (813 mm) wide minimum and 18 inches (457 mm) deep minimum, and shall comply with *Section 11B-305.7*. When used, wing walls or barriers shall project horizontally at least as far as the drinking fountain and to within 6 inches (152 mm) vertically from the floor or ground surface.

### 11B-603 Toilet and bathing rooms

**11B-603.1 General.** Toilet and bathing rooms shall comply with *Section 11B-603*.

**11B-603.2 Clearances.** Clearances shall comply with *Section 11B-603.2*.

**11B-603.2.1 Turning space.** Turning space complying with *Section 11B-304* shall be provided within the room.

**11B-603.2.2 Overlap.** Required clear floor spaces, clearance at fixtures, and turning space shall be permitted to overlap.

**11B-603.2.3 Door swing.** Doors shall not swing into the clear floor space or clearance required for any fixture. Other than the door to the accessible water closet compartment, a door in any position, may encroach into the turning space by 12 inches (305 mm) maximum.

#### Exceptions:

1. *Reserved.*
2. Where the toilet room or bathing room is for individual use and a clear floor space complying with *Section 11B-305.3* is provided within the room beyond the arc of the door swing, doors shall be permitted to swing into the clear floor space or clearance required for any fixture.

**11B-603.3 Mirrors.** Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1016 mm) maximum above the finish floor or ground. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (889 mm) maximum above the finish floor or ground.



**11B-603.4 Coat hooks, shelves and medicine cabinets.** Coat hooks shall be located within one of the reach ranges specified in Section 11B-308. Shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor. Medicine cabinets shall be located with a usable shelf no higher than 44 inches (1118 mm) maximum above the finish floor.

**11B-603.5 Accessories.** Where towel or sanitary napkin dispensers, waste receptacles, or other accessories are provided in toilet facilities, at least one of each type shall be located on an accessible route. All operable parts, including coin slots, shall be 40 inches (1016 mm) maximum above the finish floor.

**11B-603.6 Guest room toilet and bathing rooms.** Toilet and bathing rooms within guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall provide all toilet and bathing fixtures in a location that allows a person using a wheelchair measuring 30 inches by 48 inches (762 mm by 1219 mm) to touch the wheelchair to any lavatory, urinal, water closet, tub, sauna, shower stall and any other similar sanitary installation, if provided.

#### 11B-604 Water closets and toilet compartments

**11B-604.1 General.** Water closets and toilet compartments shall comply with Sections 11B-604.2 through 11B-604.8.

**Exception:** Water closets and toilet compartments for children's use shall be permitted to comply with Section 11B-604.9.

**11B-604.2 Location.** The water closet shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from the side wall or partition, except that the water closet shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the side wall or partition in the ambulatory accessible toilet compartment specified in Section 11B-604.8.2. Water closets shall be arranged for a left-hand or right-hand approach.

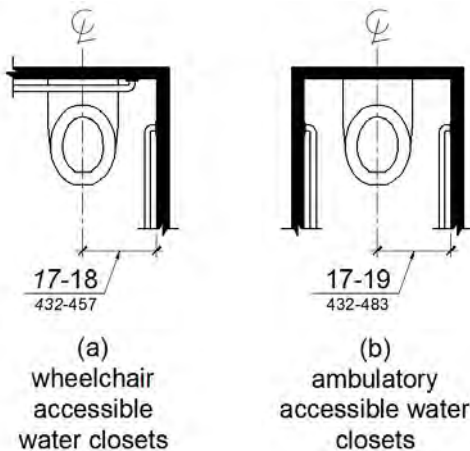


FIGURE 11B-604.2  
WATER CLOSET LOCATION

**11B-604.3 Clearance.** Clearances around water closets and in toilet compartments shall comply with Section 11B-604.3.

**11B-604.3.1 Size.** Clearance around a water closet shall be 60 inches (1524 mm) minimum measured perpendicular from the side wall and 56 inches (1422 mm) minimum measured perpendicular from the rear wall. A minimum 60 inches (1524 mm) wide and 48 inches (1219 mm) deep maneuvering space shall be provided in front of the water closet.

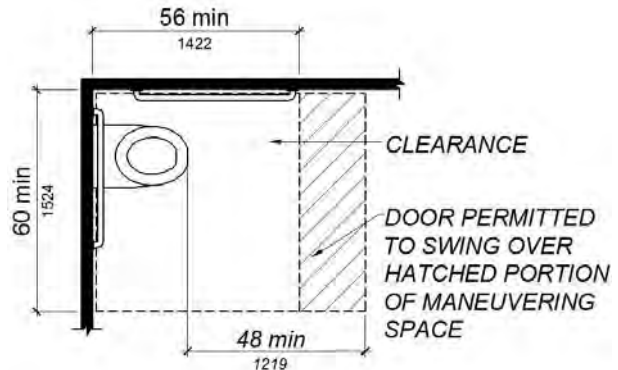


FIGURE 11B-604.3.1  
SIZE OF CLEARANCE AT WATER CLOSETS

**11B-604.3.2 Overlap.** The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures, and the turning space. No other fixtures or obstructions shall be located within the required water closet clearance.

**Exception:** In residential dwelling units, a lavatory complying with Section 11B-606 shall be permitted on the rear wall 18 inches (457 mm) minimum from the water closet centerline where the clearance at the water closet is 66 inches (1676 mm) minimum measured perpendicular from the rear wall.

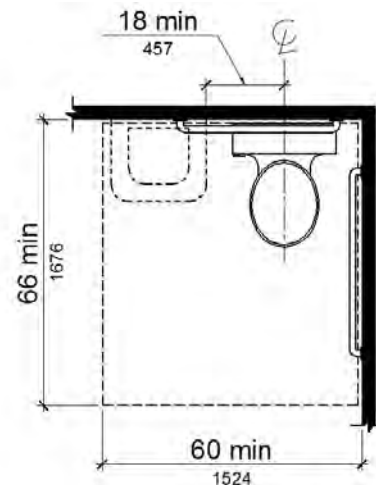


FIGURE 11B-604.3.2 (EXCEPTION)  
OVERLAP OF WATER CLOSET  
CLEARANCE IN RESIDENTIAL DWELLING UNITS

**11B-604.4 Seats.** The seat height of a water closet above the finish floor shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum measured to the top of the seat. Seats shall not be sprung to return to a lifted position. *Seats shall be 2 inches (51 mm) high maximum.*

**Exceptions:**

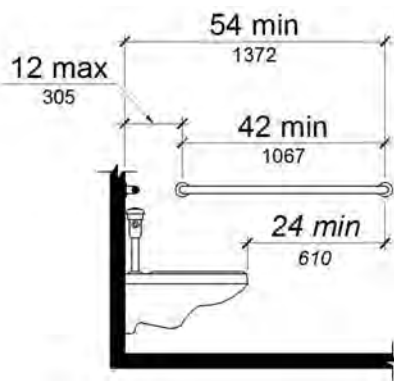
1. *Reserved.*
2. In residential dwelling units, the height of water closets shall be permitted to be 15 inches (381 mm) minimum and 19 inches (483 mm) maximum above the finish floor measured to the top of the seat.
3. A 3-inch (76 mm) high seat shall be permitted only in alterations where the existing fixture is less than 15 inches (381 mm) high.

**11B-604.5 Grab bars.** Grab bars for water closets shall comply with Section 11B-609. Grab bars shall be provided on the side wall closest to the water closet and on the rear wall. *Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped grab bar meeting the dimensional requirements of Sections 11B-604.5.1 and 11B-604.5.2 shall be permitted.*

**Exceptions:**

1. *Reserved.*
2. In residential dwelling units, grab bars shall not be required to be installed in toilet or bathrooms provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with Section 11B-604.5.
3. In detention or correction facilities, grab bars shall not be required to be installed in housing or holding cells that are specially designed without protrusions for purposes of suicide prevention.

**11B-604.5.1 Side wall.** The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extending 54 inches (1372 mm) minimum from the rear wall with the front end positioned 24 inches (610 mm) minimum in front of the water closet.

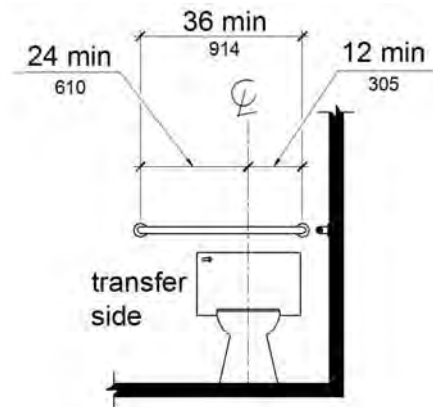


**FIGURE 11B-604.5.1**  
**SIDE WALL GRAB BAR AT WATER CLOSETS**

**11B-604.5.2 Rear wall.** The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

**Exceptions:**

1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, where wall space does not permit a length of 36 inches (914 mm) minimum due to the location of a recessed fixture adjacent to the water closet.
2. Where an administrative authority requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.

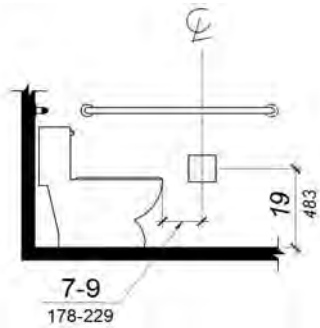


**FIGURE 11B-604.5.2**  
**REAR WALL GRAB BAR AT WATER CLOSETS**

**11B-604.6 Flush controls.** Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with Section 11B-309 except they shall be located 44 inches (1118 mm) maximum above the floor. Flush controls shall be located on the open side of the water closet except in ambulatory accessible compartments complying with Section 11B-604.8.2.

**11B-604.7 Dispensers.** Toilet paper dispensers shall comply with Section 11B-309.4 and shall be 7 inches (178 mm) minimum and 9 inches (229 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be below the grab bar, 19 inches (483 mm) minimum above the finish floor and shall not be located behind grab bars. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow.

**11B-604.8 Toilet compartments.** Wheelchair accessible toilet compartments shall meet the requirements of Sections 11B-604.8.1 and 11B-604.8.3. Compartments containing more than one plumbing fixture shall comply with Section 11B-603. Ambulatory accessible compartments shall comply with Sections 11B-604.8.2 and 11B-604.8.3.



**FIGURE 11B-604.7**  
**DISPENSER OUTLET LOCATION**

**11B-604.8.1 Wheelchair accessible compartments.** Wheelchair accessible compartments shall comply with Section 11B-604.8.1.

**11B-604.8.1.1 Size.** Wheelchair accessible compartments shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, and 56 inches (1422 mm) deep minimum for wall hung water closets and 59 inches (1499 mm) deep minimum for floor mounted water closets measured perpendicular to the rear wall. Wheelchair accessible compartments for children's use shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, and 59 inches (1499 mm) deep minimum for wall hung and floor mounted water closets measured perpendicular to the rear wall.

**11B-604.8.1.1.1 Maneuvering space with in-swinging door.** In a wheelchair accessible compartment with an in-swinging door, a minimum 60 inches (1524 mm) wide by 36 inches (914 mm) deep maneuvering space shall be provided in front of the clearance required in Section 11B-604.8.1.1. See Figures 11B-604.8.1.1.2 (b) and 11B-604.8.1.1.3 (b).

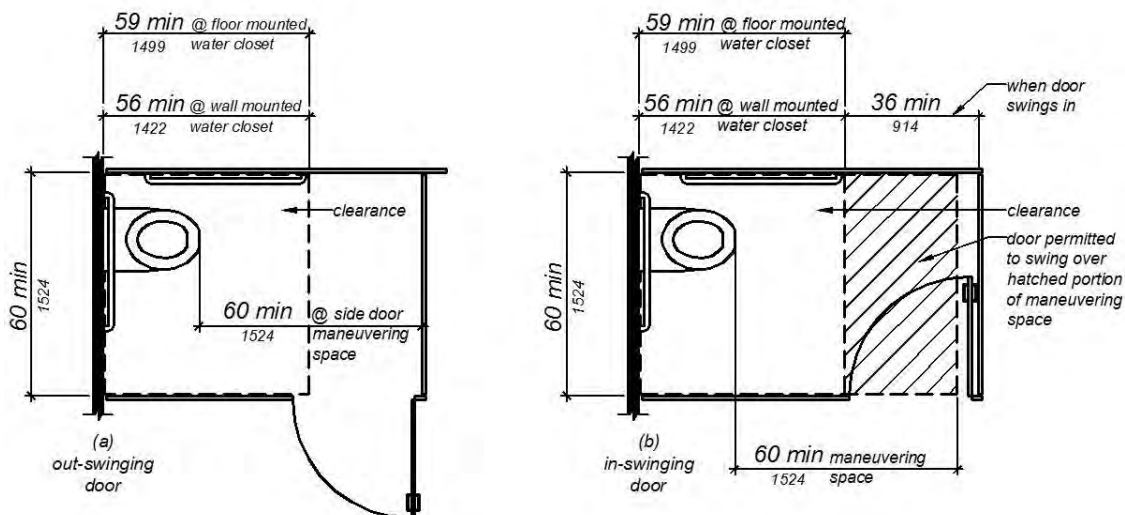
**11B-604.8.1.1.2 Maneuvering space with side-opening door.** In a wheelchair accessible compart-

ment with a side-opening door, either in-swinging or out-swinging, a minimum 60 inches (1524 mm) wide and 60 inches (1524 mm) deep maneuvering space shall be provided in front of the water closet. See Figure 11B-604.8.1.1.2.

**11B-604.8.1.1.3 Maneuvering space with end-opening door.** In a wheelchair accessible compartment with an end-opening door (facing the water closet), either in-swinging or out-swinging, a minimum 60 inches (1524 mm) wide and 48 inches (1219 mm) deep maneuvering space shall be provided in front of the water closet. See Figure 11B-604.8.1.1.3.

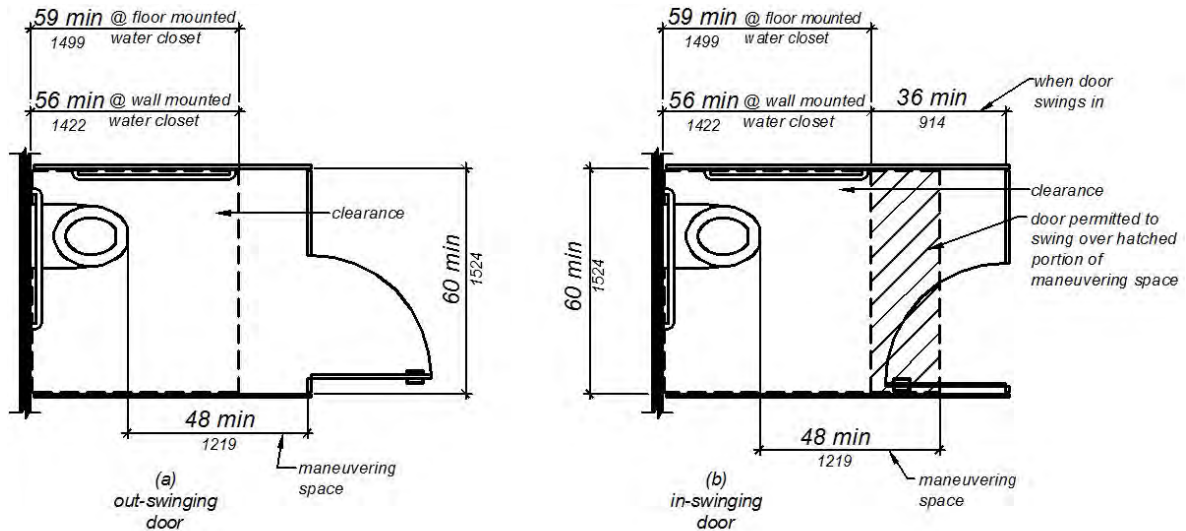
**11B-604.8.1.2 Doors.** Toilet compartment doors, including door hardware, shall comply with Section 11B-404 except that if the approach is from the push side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 48 inches (1219 mm) minimum measured perpendicular to the compartment door in its closed position. Doors shall be located in the front partition or in the side wall or partition farthest from the water closet. Where located in the front partition, the door opening shall be 4 inches (102 mm) maximum from the side wall or partition farthest from the water closet. Where located in the side wall or partition, the door opening shall be 4 inches (102 mm) maximum from the front partition. The door shall be self-closing. A door pull complying with Section 11B-404.2.7 shall be placed on both sides of the door near the latch. Doors shall not swing into the clear floor space or clearance required for any fixture. Doors may swing into that portion of maneuvering space which does not overlap the clearance required at a water closet.

**Exception:** When located at the side of a toilet compartment, the toilet compartment door opening shall provide a clear width of 34 inches (864 mm) minimum.

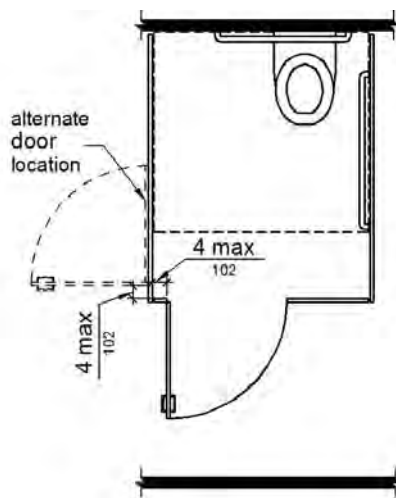


**FIGURE 11B-604.8.1.1.2**  
**MANEUVERING SPACE WITH SIDE-OPENING DOOR**





**FIGURE 11B-604.8.1.1.3**  
**MANEUVERING SPACE WITH END-OPENING DOOR**



**FIGURE 11B-604.8.1.2**  
**WHEELCHAIR ACCESSIBLE TOILET COMPARTMENT DOORS**

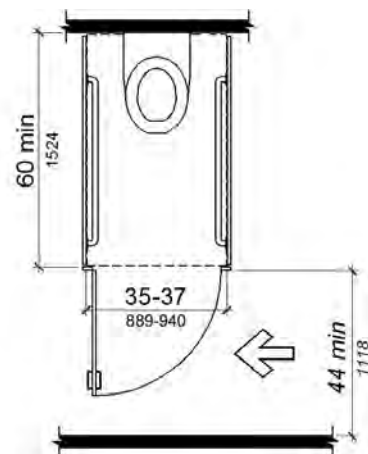
**11B-604.8.1.3 Approach.** Compartments shall be arranged for left-hand or right-hand approach to the water closet.

**11B-604.8.1.4 Toe clearance.** At least one side partition shall provide a toe clearance of 9 inches (229 mm) minimum above the finish floor and 6 inches (152 mm) deep minimum beyond the compartment-side face of the partition, exclusive of partition support members. *Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces.* Compartments for children's use shall provide a toe clearance of 12 inches (305 mm) minimum above the finish floor.

**Exception:** Toe clearance at the side partition is not required in a compartment greater than 66 inches (1676 mm) wide.

**11B-604.8.1.5 Grab bars.** Grab bars shall comply with Section 11B-609. A side-wall grab bar complying with Section 11B-604.5.1 shall be provided and shall be located on the wall closest to the water closet. In addition, a rear-wall grab bar complying with Section 11B-604.5.2 shall be provided. *Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped grab bar meeting the dimensional requirements of Sections 11B-604.5.1 and 11B-604.5.2 shall be permitted.*

**11B-604.8.2 Ambulatory accessible compartments.** Ambulatory accessible compartments shall comply with Section 11B-604.8.2.



**11B-604.8.2**  
**AMBULATORY ACCESSIBLE TOILET COMPARTMENT**

**11B-604.8.2.1 Size.** Ambulatory accessible compartments shall have a depth of 60 inches (1524 mm) minimum and a width of 35 inches (889 mm) minimum and 37 inches (940 mm) maximum.

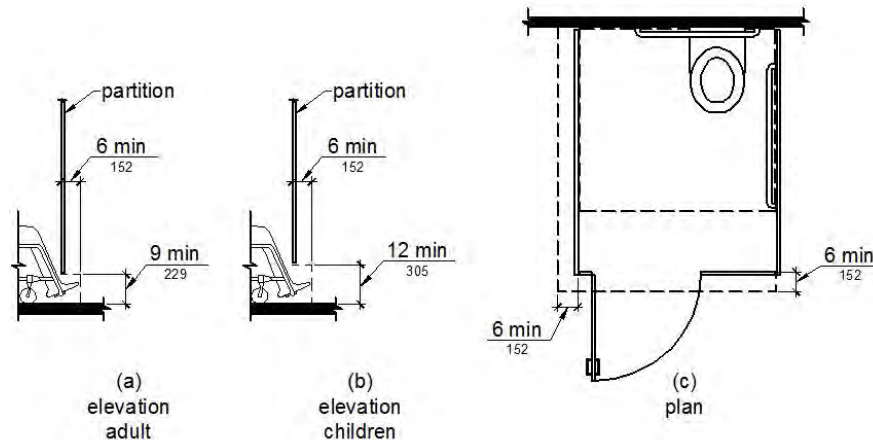


FIGURE 11B-604.8.1.4  
WHEELCHAIR ACCESSIBLE TOILET COMPARTMENT TOE CLEARANCE

**11B-604.8.2.2 Doors.** Toilet compartment doors, including door hardware, shall comply with *Section 11B-404*, except that if the approach is to the latch side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches (1118 mm) minimum. The door shall be self-closing. A door pull complying with *Section 11B-404.2.7* shall be placed on both sides of the door near the latch. Toilet compartment doors shall not swing into the minimum required compartment area.

**11B-604.8.2.3 Grab bars.** Grab bars shall comply with *Section 11B-609*. A side-wall grab bar complying with *Section 11B-604.5.1* shall be provided on both sides of the compartment.

**11B-604.8.3 Coat hooks and shelves.** Coat hooks shall be located within one of the reach ranges specified in *Section 11B-308*. Shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor.

**11B-604.9 Water closets and toilet compartments for children's use.** Water closets and toilet compartments for children's use shall comply with *Section 11B-604.9*.

**11B-604.9.1 Location.** The water closet shall be located with a wall or partition to the rear and to one side. The centerline of the water closet shall be 12 inches (305 mm) minimum and 18 inches (457 mm) maximum from the side wall or partition, except that the water closet shall be

17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the side wall or partition in the ambulatory accessible toilet compartment specified in *Section 11B-604.8.2*. Compartments shall be arranged for left-hand or right-hand approach to the water closet.

**11B-604.9.2 Clearance.** Clearance around a water closet shall comply with *Section 11B-604.3*.

**11B-604.9.3 Height.** The height of water closets shall be 11 inches (279 mm) minimum and 17 inches (432 mm) maximum measured to the top of the seat. Seats shall not be sprung to return to a lifted position.

**11B-604.9.4 Grab bars.** Grab bars for water closets shall comply with *Section 11B-604.5*.

**11B-604.9.5 Flush controls.** Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with *Sections 11B-309.2* and *11B-309.4* and shall be installed 36 inches (914 mm) maximum above the finish floor. Flush controls shall be located on the open side of the water closet except in ambulatory accessible compartments complying with *Section 11B-604.8.2*.

**11B-604.9.6 Dispensers.** Toilet paper dispensers shall comply with *Section 11B-309.4* and shall be 7 inches (178 mm) minimum and 9 inches (229 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be 14 inches (356 mm) minimum and 19 inches (483 mm) maximum above

TABLE 11B-604.9  
SUGGESTED DIMENSIONS FOR CHILDREN'S USE

SUGGESTED DIMENSIONS FOR WATER CLOSETS SERVING CHILDREN AGES 3 THROUGH 12			
	Ages 3 and 4	Ages 5 through 8	Ages 9 through 12
Water Closet Centerline	12 inches (305 mm)	12 to 15 inches (305 to 381 mm)	15 to 18 inches (381 to 457 mm)
Toilet Seat Height	11 to 12 inches (279 to 305 mm)	12 to 15 inches (305 to 381 mm)	15 to 17 inches (381 to 432 mm)
Grab Bar Height	18 to 20 inches (457 to 508 mm)	20 to 25 inches (508 to 635 mm)	25 to 27 inches (635 to 686 mm)
Dispenser Height	14 inches (356 mm)	14 to 17 inches (356 to 432 mm)	17 to 19 inches (432 to 483 mm)

the finish floor. There shall be a clearance of 1½ inches (38 mm) minimum below the grab bar. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow.

**11B-604.9.7 Toilet compartments.** Toilet compartments shall comply with *Section 11B-604.8*.

### 11B-605 Urinals

**11B-605.1 General.** Urinals shall comply with *Section 11B-605*.

**11B-605.2 Height and depth.** Urinals shall be the stall-type or the wall-hung type with the rim **17 inches (432 mm) maximum** above the finish floor or ground. Urinals shall be 13½ inches (343 mm) deep minimum measured from the outer face of the urinal rim to the back of the fixture.

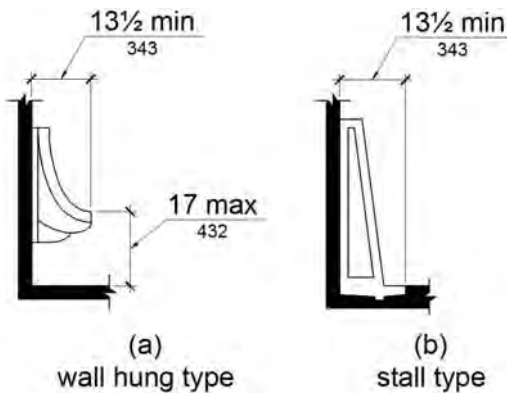


FIGURE 11B-605.2  
HEIGHT AND DEPTH OF URINALS

**11B-605.3 Clear floor space.** A clear floor or ground space complying with *Section 11B-305* positioned for forward approach shall be provided.

**11B-605.4 Flush controls.** Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with *Section 11B-309* except that the flush control shall be mounted at a maximum height of 44 inches (1118 mm) above the finish floor.

### 11B-606 Lavatories and sinks

**11B-606.1 General.** Lavatories and sinks shall comply with *Section 11B-606*.

**11B-606.2 Clear floor space.** A clear floor space complying with *Section 11B-305*, positioned for a forward approach, and knee and toe clearance complying with *Section 11B-306* shall be provided.

#### Exceptions:

1. A parallel approach complying with *Section 11B-305* shall be permitted to a kitchen sink in a space where a cook top or conventional range is not provided and to wet bars.
2. *Reserved.*

3. In residential dwelling units, cabinetry shall be permitted under lavatories and kitchen sinks provided that all of the following conditions are met:

- (a) the cabinetry can be removed without removal or replacement of the fixture;
- (b) the finish floor extends under the cabinetry; and
- (c) the walls behind and surrounding the cabinetry are finished.

4. A knee clearance of 24 inches (610 mm) minimum above the finish floor or ground shall be permitted at lavatories and sinks used primarily by children 6 through 12 years where the rim or counter surface is 31 inches (787 mm) maximum above the finish floor or ground.

5. A parallel approach complying with *Section 11B-305* shall be permitted to lavatories and sinks used primarily by children 5 years and younger.

6. The dip of the overflow shall not be considered in determining knee and toe clearances.

7. No more than one bowl of a multi-bowl sink shall be required to provide knee and toe clearance complying with *Section 11B-306*.

**11B-606.3 Height.** Lavatories and sinks shall be installed with the front of the higher of the rim or counter surface 34 inches (864 mm) maximum above the finish floor or ground.

#### Exceptions:

1. *Reserved.*
2. In residential dwelling unit kitchens, sinks that are adjustable to variable heights, 29 inches (737 mm) minimum and 36 inches (914 mm) maximum, shall be permitted where rough-in plumbing permits connections of supply and drain pipes for sinks mounted at the height of 29 inches (737 mm).

**11B-606.4 Faucets.** Controls for faucets shall comply with *Section 11B-309*. Hand-operated metering faucets shall remain open for 10 seconds minimum.

**11B-606.5 Exposed pipes and surfaces.** Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks.

**11B-606.6 Adjacent side wall or partition.** Lavatories, when located adjacent to a side wall or partition, shall be a minimum of 18 inches (457 mm) to the centerline of the fixture.

**11B-606.7 Sink depth.** Sinks shall be 6½ inches (165 mm) deep maximum.

### 11B-607 Bathtubs

**11B-607.1 General.** Bathtubs shall comply with *Section 11B-607*.

**11B-607.2 Clearance.** Clearance in front of bathtubs shall extend the length of the bathtub and shall be 48 inches (1219 mm) wide minimum for forward approach and 30 inches (762 mm) wide minimum for side approach.

mm) wide minimum for parallel approach. A lavatory complying with Section 11B-606 shall be permitted at the control end of the clearance. Where a permanent seat is provided at the head end of the bathtub, the clearance shall extend 12 inches (305 mm) minimum beyond the wall at the head end of the bathtub.

**11B-607.3 Seat.** A permanent seat at the head end of the bathtub or a removable in-tub seat shall be provided. Seats shall comply with Section 11B-610.

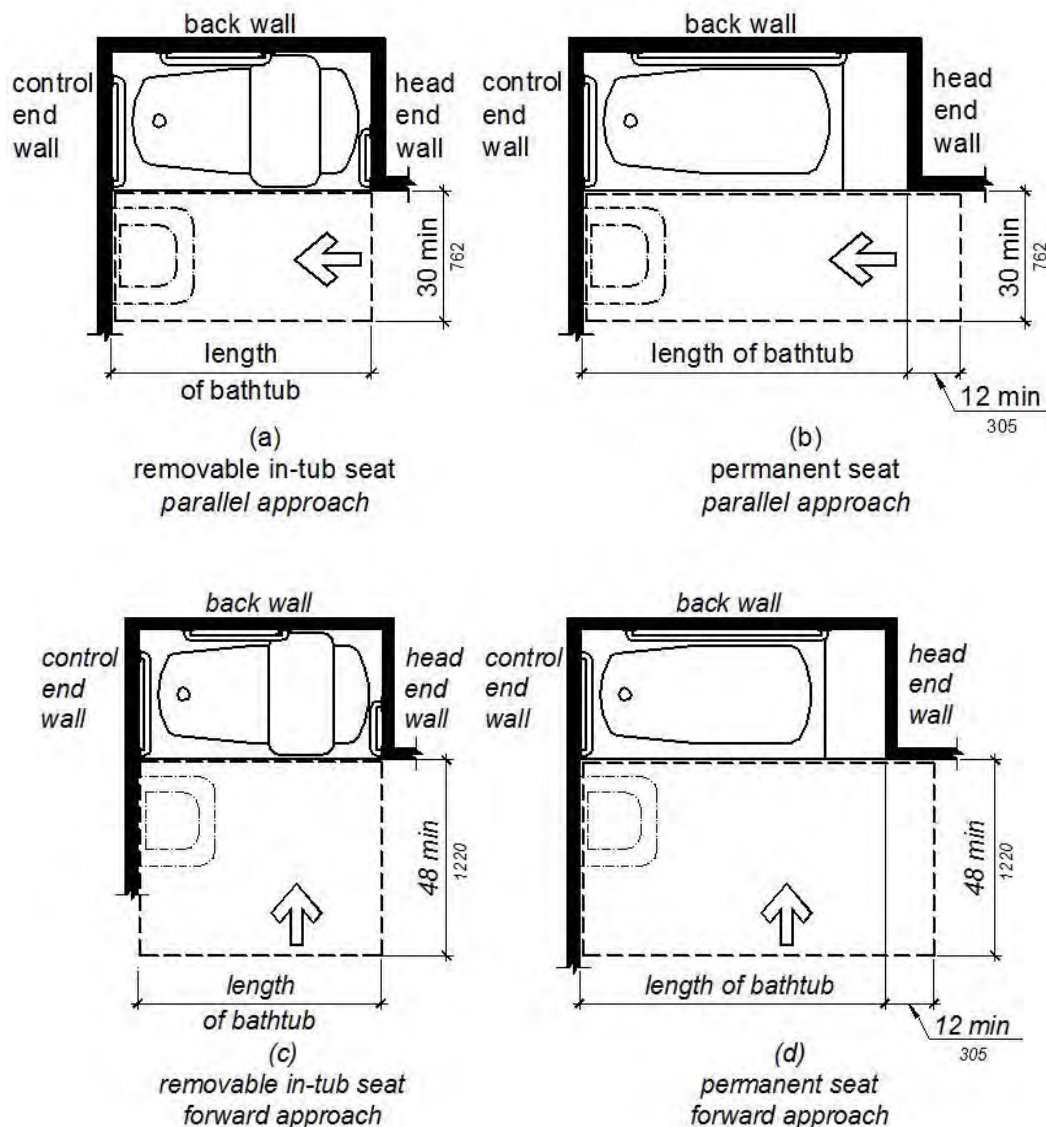
**11B-607.4 Grab bars.** Grab bars for bathtubs shall comply with Section 11B-609 and shall be provided in accordance with Section 11B-607.4.1 or 11B-607.4.2. Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting

the dimensional requirements of Section 11B-607.4.1 or 11B-607.4.2 shall be permitted.

**Exceptions:**

1. **Reserved.**
2. In residential dwelling units, grab bars shall not be required to be installed in bathtubs located in bathing facilities provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with Section 11B-607.4.

**11B-607.4.1 Bathtubs with permanent seats.** For bathtubs with permanent seats, grab bars shall be provided in accordance with Section 11B-607.4.1.



**FIGURE 11B-607.2**  
**CLEARANCE FOR BATHTUBS**



**11B-607.4.1.1 Back wall.** Two grab bars shall be installed on the back wall, one located in accordance with *Section 11B-609.4* and the other located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be installed 15 inches (381 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

**11B-607.4.1.2 Control end wall.** A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub.

**11B-607.4.2 Bathtubs without permanent seats.** For bathtubs without permanent seats, grab bars shall comply with *Section 11B-607.4.2*.

**11B-607.4.2.1 Back wall.** Two grab bars shall be installed on the back wall, one located in accordance with *Section 11B-609.4* and the other located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be 24 inches (610 mm) long minimum and shall be installed 24 inches (610 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

**11B-607.4.2.2 Control end wall.** A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub.

**11B-607.4.2.3 Head end wall.** A grab bar 12 inches (305 mm) long minimum shall be installed on the head end wall at the front edge of the bathtub.

**11B-607.5 Controls.** Controls, other than drain stoppers, shall be located on an end wall. Controls shall be between the bathtub rim and grab bar, and between the open side of the bathtub and the centerline of the width of the bathtub. Controls shall comply with *Section 11B-309.4*.

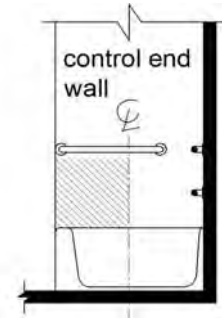


FIGURE 11B-607.5  
BATHTUB CONTROL LOCATION

**11B-607.6 Shower spray unit and water.** A shower spray unit with a hose 59 inches (1499 mm) long minimum that can be used both as a fixed-position shower head and as a handheld shower shall be provided. The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars. Bathtub shower spray units shall deliver water that is 120°F (49°C) maximum.

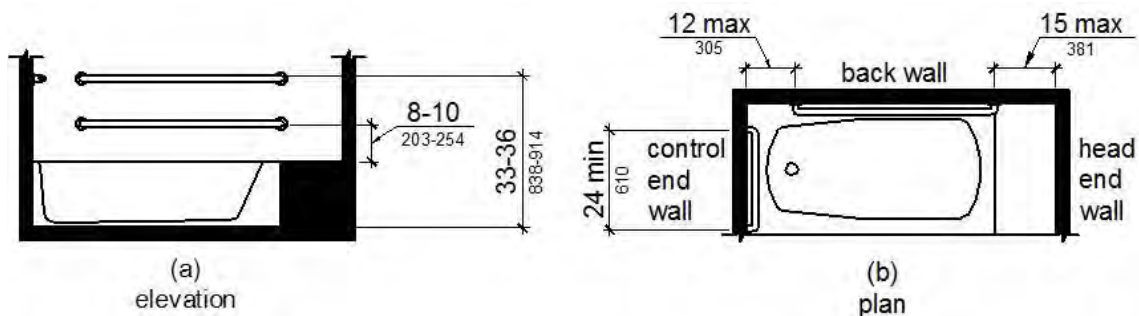


FIGURE 11B-607.4.1  
GRAB BARS FOR BATHTUBS WITH PERMANENT SEATS

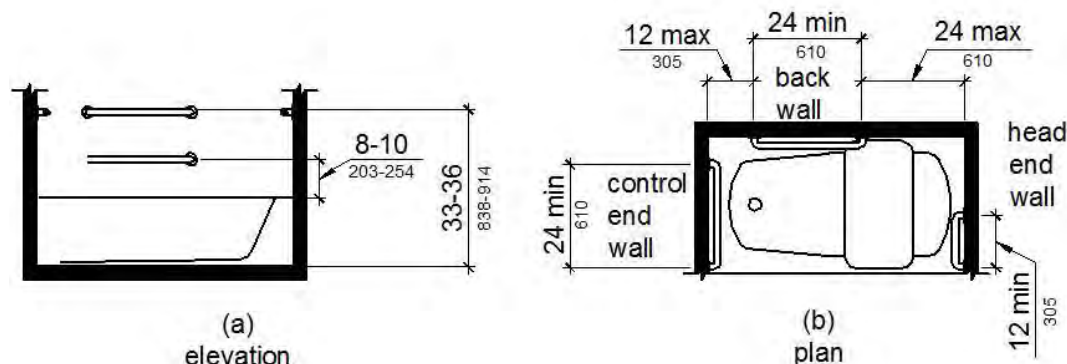


FIGURE 11B-607.4.2  
GRAB BARS FOR BATHTUBS WITH REMOVABLE IN-TUB SEATS

**11B-607.7 Bathtub enclosures.** Enclosures for bathtubs shall not obstruct controls, faucets, shower and spray units or obstruct transfer from wheelchairs onto bathtub seats or into bathtubs. Enclosures on bathtubs shall not have tracks installed on the rim of the open face of the bathtub.

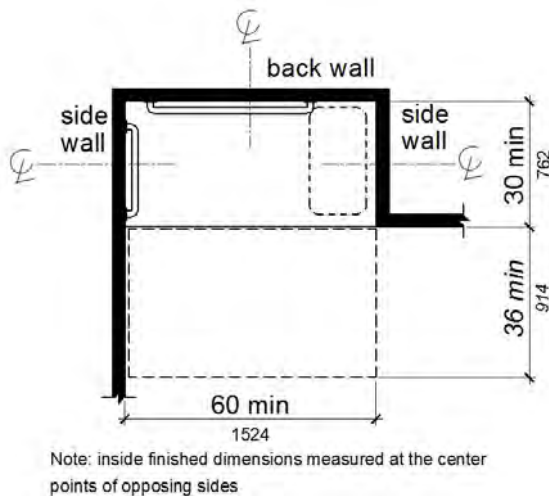
#### 11B-608 Shower compartments

**11B-608.1 General.** Shower compartments shall comply with *Section 11B-608*.

**11B-608.2 Size and clearances for shower compartments.** Shower compartments shall have sizes and clearances complying with *Section 11B-608.2*.

##### 11B-608.2.1 Reserved.

**11B-608.2.2 Standard roll-in type shower compartments.** Standard roll-in type shower compartments shall be 30 inches (762 mm) wide minimum by 60 inches (1524 mm) deep minimum clear inside dimensions measured at center points of opposing sides *with a full opening width on the long side*.



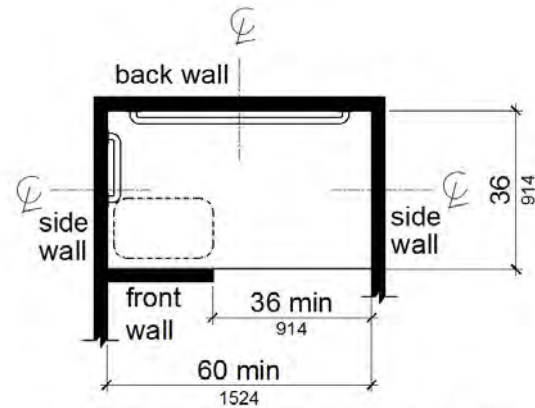
**FIGURE 11B-608.2.2  
STANDARD ROLL-IN TYPE  
SHOWER COMPARTMENT SIZE AND CLEARANCE**

**11B-608.2.2.1 Clearance.** A 36 inch (914 mm) wide minimum by 60 inch (1524 mm) long minimum clearance shall be provided adjacent to the open face of the shower compartment.

**Exception: Reserved.**

**11B-608.2.3 Alternate roll-in type shower compartments.** Alternate roll-in type shower compartments shall be 36 inches (914 mm) wide and 60 inches (1524 mm) deep minimum clear inside dimensions measured at center points of opposing sides. A 36 inch (914 mm) wide minimum entry shall be provided at one end of the long side of the compartment.

**11B-608.3 Grab bars.** Grab bars shall comply with *Section 11B-609* and shall be provided in accordance with *Section 11B-608.3*. Where multiple grab bars are used, required horizontal grab bars shall be installed at the same height above the finish floor. *Where separate grab bars are required on*



**FIGURE 11B-608.2.3  
ALTERNATE ROLL-IN TYPE  
SHOWER COMPARTMENT SIZE AND CLEARANCE**

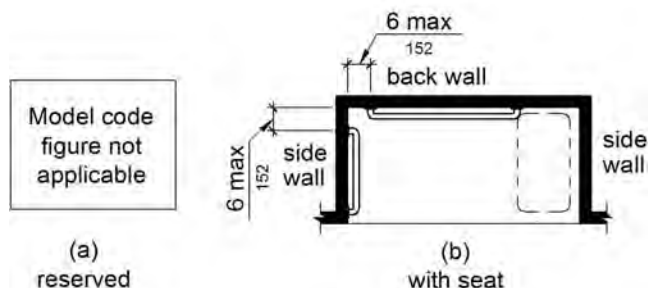
*adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting the dimensional requirements of Section 11B-608.3.2 or 11B-608.3.3 shall be permitted.*

#### Exceptions:

1. *Reserved.*
2. In residential dwelling units, grab bars shall not be required to be installed in showers located in bathing facilities provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with *Section 11B-608.3*.

##### 11B-608.3.1 Reserved.

**11B-608.3.2 Standard roll-in type shower compartments.** Grab bars shall be provided on the back wall and the side wall opposite the seat. Grab bars shall not be provided above the seat. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.



**FIGURE 11B-608.3.2  
GRAB BARS FOR STANDARD ROLL-IN TYPE SHOWER**

**11B-608.3.3 Alternate roll-in type shower compartments.** In alternate roll-in type shower compartments, grab bars shall be provided on the back wall and the side wall farthest from the compartment entry. Grab bars shall

not be provided above the seat. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

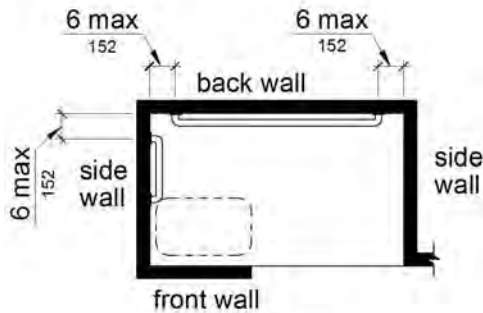


FIGURE 11B-608.3.3  
GRAB BARS FOR ALTERNATE ROLL-IN TYPE SHOWERS

**11B-608.4 Seats.** A folding seat shall be provided in roll-in type showers. Seats shall comply with Section 11B-610.

**Exception:** In residential dwelling units, seats shall not be required in shower compartments provided that reinforcement has been installed in walls so as to permit the installation of seats complying with Section 11B-608.4.

**11B-608.5 Controls.** Controls, faucets, and shower spray units shall comply with Section 11B-309.4. *Controls and faucets shall be of a single-lever design.*

**11B-608.5.1 Reserved.**

**11B-608.5.2 Standard roll-in type shower compartments.** In standard roll-in type shower compartments, operable parts of controls and faucets shall be installed on the back wall of the compartment adjacent to the seat wall 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall; and shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor, with their centerline at 39 inches (991 mm) to 41 inches (1041 mm) above the shower floor.

Operable parts of the shower spray unit, including the handle, shall be installed on the back wall adjacent to the seat wall 19 inches (483 mm) minimum and 27 inches (686

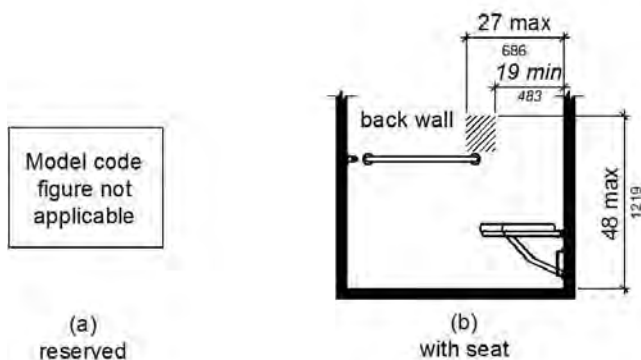


FIGURE 11B-608.5.2  
STANDARD ROLL-IN TYPE  
SHOWER COMPARTMENT CONTROL LOCATION

mm) maximum from the seat wall; and shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor.

**11B-608.5.3 Alternate roll-in type shower compartments.** In alternate roll-in type shower compartments, operable parts of controls and faucets shall be installed on the side wall of the compartment adjacent to the seat wall 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall; and shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor, with their centerline at 39 inches (991 mm) to 41 inches (1041 mm) above the shower floor.

Operable parts of the shower spray unit, including the handle, shall be installed on the side wall of the compartment adjacent to the seat wall 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the seat wall or on the back wall opposite the seat 15 inches (381 mm) maximum, left or right, of the centerline of the seat; and shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor.

**11B-608.6 Shower spray unit and water.** A shower spray unit with a hose 59 inches (1499 mm) long minimum that can be used both as a fixed-position shower head and as a handheld shower shall be provided. The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars. Shower spray units shall deliver water that is 120°F (49°C) maximum.

**Exception:** Where subject to excessive vandalism, two fixed shower heads shall be installed instead of a handheld spray unit in facilities that are not transient lodging guest rooms. Each shower head shall be installed so it can be operated independently of the other and shall have swivel angle adjustments, both vertically and horizontally.

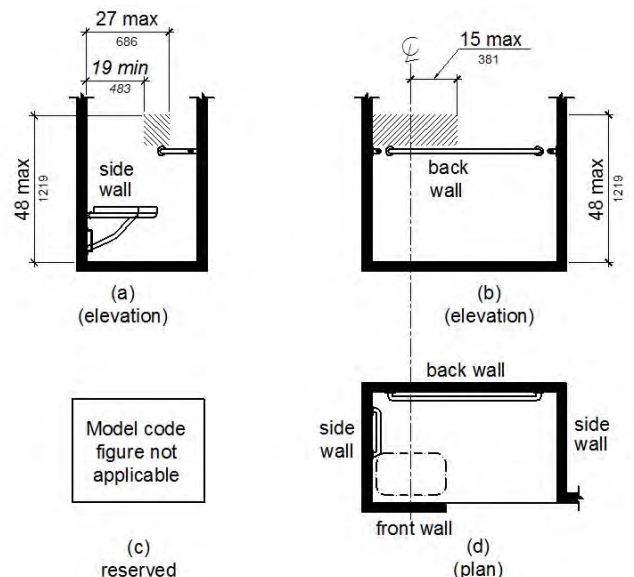


FIGURE 11B-608.5.3  
ALTERNATE ROLL-IN TYPE  
SHOWER COMPARTMENT CONTROL LOCATION

**11B-608.7 Thresholds.** Thresholds in roll-in type shower compartments shall be  $\frac{1}{2}$  inch (12.7 mm) high maximum in accordance with *Section 11B-303*.

**Exception: Reserved.**

**11B-608.8 Shower enclosures.** Enclosures for shower compartments shall not obstruct controls, faucets, and shower spray units or obstruct transfer from wheelchairs onto shower seats.

**11B-608.9 Shower floor or ground surface.** Floor or ground surfaces of showers shall comply with *Section 11B-302.1* and shall be sloped 1:48 maximum in any direction. Where drains are provided, grate openings shall be  $\frac{1}{4}$  inch (6.4 mm) maximum and flush with the floor surface.

**11B-608.10 Soap dish.** Where a soap dish is provided, it shall be located on the control wall at 40 inches (1016 mm) maximum above the shower floor, and within the reach limits from the seat.

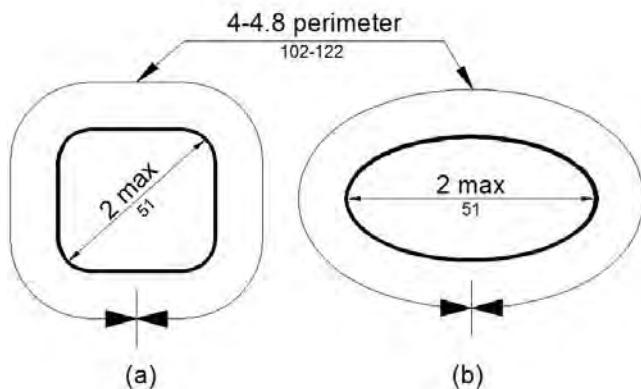
### 11B-609 Grab bars

**11B-609.1 General.** Grab bars in toilet facilities and bathing facilities shall comply with *Section 11B-609*.

**11B-609.2 Cross section.** Grab bars shall have a cross section complying with *Section 11B-609.2.1* or *11B-609.2.2*.

**11B-609.2.1 Circular cross section.** Grab bars with circular cross sections shall have an outside diameter of  $1\frac{1}{4}$  inches (32 mm) minimum and 2 inches (51 mm) maximum.

**11B-609.2.2 Non-circular cross section.** Grab bars with non-circular cross sections shall have a cross-section dimension of 2 inches (51 mm) maximum and a perimeter dimension of 4 inches (102 mm) minimum and 4.8 inches (122 mm) maximum.

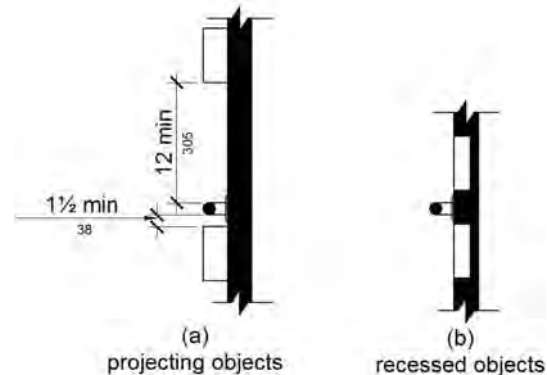


**FIGURE 11B-609.2.2**  
**GRAB BAR NON-CIRCULAR CROSS SECTION**

**11B-609.3 Spacing.** The space between the wall and the grab bar shall be  $1\frac{1}{2}$  inches (38 mm). The space between the grab bar and projecting objects below and at the ends shall be  $1\frac{1}{2}$  inches (38 mm) minimum. The space between the grab bar and projecting objects above shall be 12 inches (305 mm) minimum.

### Exceptions:

1. The space between the grab bars and shower controls, shower fittings, and other grab bars above shall be permitted to be  $1\frac{1}{2}$  inches (38 mm) minimum.
2. For L-shaped or U-shaped grab bars complying with *Section 11B-609.9* the space between the walls and the grab bar shall be  $1\frac{1}{2}$  inches (38 mm) minimum for a distance of 6 inches on either side of the inside corner between two adjacent wall surfaces.



**FIGURE 11B-609.3**  
**SPACING OF GRAB BARS**

**11B-609.4 Position of grab bars.** Grab bars shall be installed in a horizontal position, 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, except that at water closets for children's use complying with *Section 11B-604.9*, grab bars shall be installed in a horizontal position 18 inches (457 mm) minimum and 27 inches (686 mm) maximum above the finish floor measured to the top of the gripping surface. The height of the lower grab bar on the back wall of a bathtub shall comply with *Section 11B-607.4.1.1* or *11B-607.4.2.1*.

**11B-609.5 Surface hazards.** Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges.

**11B-609.6 Fittings.** Grab bars shall not rotate within their fittings.

**11B-609.7 Installation.** Grab bars shall be installed in any manner that provides a gripping surface at the specified locations and that does not obstruct the required clear floor space.

**11B-609.8 Structural strength.** Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the grab bar, fastener, mounting device, or supporting structure.

**11B-609.9 Alternate configuration.** L-shaped or U-shaped grab bars shall be permitted.

### 11B-610 Seats

**11B-610.1 General.** Seats in bathtubs and shower compartments shall comply with *Section 11B-610*.

**11B-610.2 Bathtub seats.** The top of bathtub seats shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maxi-



15 inches (381 mm) minimum and 16 inches (406 mm) maximum. The seat shall be capable of secure placement. Permanent seats at the head end of the bathtub shall be 15 inches (381 mm) deep minimum and shall extend from the back wall to or beyond the outer edge of the bathtub.

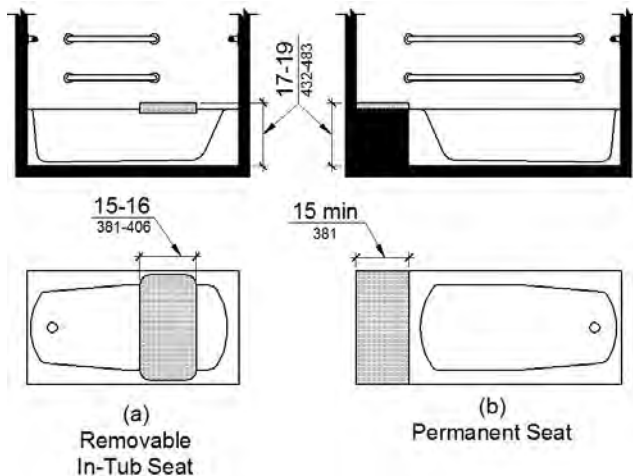


FIGURE 11B-610.2  
BATHTUB SEATS

**11B-610.3 Shower compartment seats.** A seat in a standard roll-in shower compartment shall be a folding type, shall be installed on the side wall adjacent to the controls, and shall extend from the back wall to a point within 3 inches (76 mm) of the compartment entry. A seat in an alternate roll-in type shower compartment shall be a folding type, shall be installed on the front wall opposite the back wall, and shall extend from the adjacent side wall to a point within 3 inches (76 mm) of the compartment entry. The top of the seat shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. When folded, the seat shall extend 6 inches (152 mm) maximum from the mounting wall. Seats shall comply with Section 11B-610.3.1 or 11B-610.3.2.

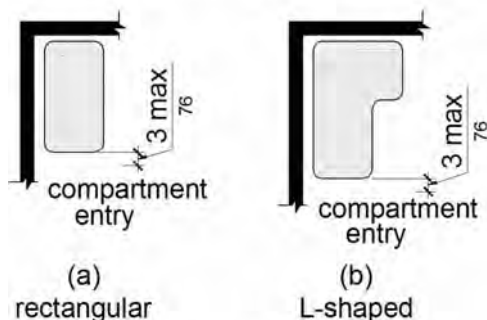


FIGURE 11B-610.3  
EXTENT OF SEAT

**11B-610.3.1 Rectangular seats.** The rear edge of a rectangular seat shall be 2½ inches (64 mm) maximum and the front edge 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The side

edge of the seat shall be 1½ inches (38 mm) maximum from the adjacent wall.

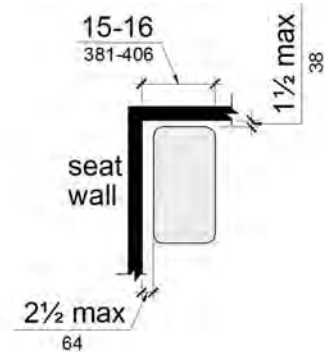


FIGURE 11B-610.3.1  
RECTANGULAR SHOWER SEAT

**11B-610.3.2 L-shaped seats.** The rear edge of an L-shaped seat shall be 2½ inches (64 mm) maximum and the front edge 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The rear edge of the “L” portion of the seat shall be 1½ inches (38 mm) maximum from the wall and the front edge shall be 14 inches (356 mm) minimum and 15 inches (381 mm) maximum from the wall. The end of the “L” shall be 22 inches (559 mm) minimum and 23 inches (584 mm) maximum from the main seat wall.

**11B-610.4 Structural strength.** Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device, or supporting structure.

#### 11B-611 Washing machines and clothes dryers

**11B-611.1 General.** Washing machines and clothes dryers shall comply with Section 11B-611.

**11B-611.2 Clear floor space.** A clear floor or ground space complying with Section 11B-305 positioned for parallel approach shall be provided. The clear floor or ground space shall be centered on the appliance.

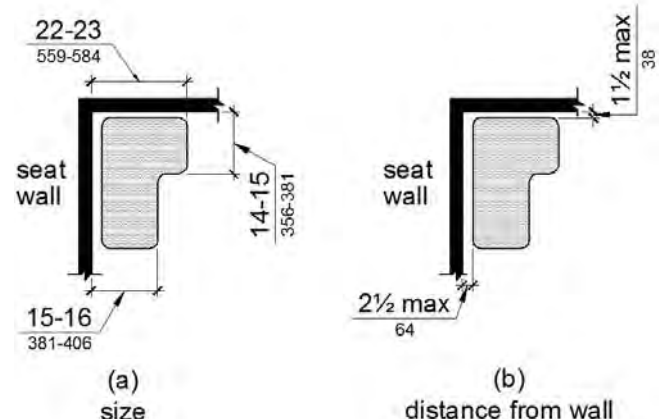
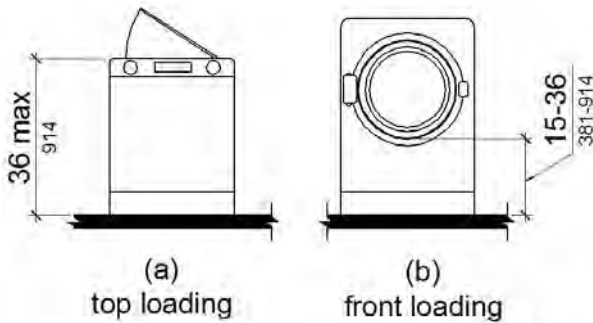


FIGURE 11B-610.3.2  
L-SHAPED SHOWER SEAT

**11B-611.3 Operable parts.** Operable parts, including doors, lint screens, and detergent and bleach compartments shall comply with *Section 11B-309*.

**11B-611.4 Height.** Top loading machines shall have the door to the laundry compartment located 36 inches (914 mm) maximum above the finish floor. Front loading machines shall have the bottom of the opening to the laundry compartment located 15 inches (381 mm) minimum and 36 inches (914 mm) maximum above the finish floor.



**FIGURE 11B-611.4**  
**HEIGHT OF LAUNDRY COMPARTMENT OPENING**

#### **11B-612 Saunas and steam rooms**

**11B-612.1 General.** Saunas and steam rooms shall comply with *Section 11B-612*.

**11B-612.2 Bench.** Where seating is provided in saunas and steam rooms, at least one bench shall comply with *Section 11B-903*. Doors shall not swing into the clear floor space required by *Section 11B-903.2*.

**Exception:** A readily removable bench shall be permitted to obstruct the turning space required by *Section 11B-612.3* and the clear floor or ground space required by *Section 11B-903.2*.

**11B-612.3 Turning space.** A turning space complying with *Section 11B-304* shall be provided within saunas and steam rooms.

## DIVISION 7: COMMUNICATION ELEMENTS AND FEATURES

### 11B-701 General

**11B-701.1 Scope.** The provisions of *Division 7* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-702 Fire alarm systems

**11B-702.1 General.** Fire alarm systems shall have permanently installed audible and visible alarms complying with NFPA 72 and *Chapter 9, Sections 907.5.2.1 and 907.5.2.3*.

**Exception:** *Reserved.*

### 11B-703 Signs

**11B-703.1 General.** Signs shall comply with *Section 11B-703*. Where both visual and tactile characters are required, either one sign with both visual and tactile characters, or two separate signs, one with visual, and one with tactile characters, shall be provided.

**11B-703.1.1 Plan review and inspection.** Signs as specified in *Section 11B-703*, or in other sections of this code, when included in the construction of new buildings or facilities, or when included, altered or replaced due to additions, alterations or renovations to existing buildings or facilities, and when a permit is required, shall comply with *Sections 11B-703.1.1.1 and 11B-703.1.1.2*.

**11B-703.1.1.1 Plan review.** Plans, specifications or other information indicating compliance with these regulations shall be submitted to the enforcing agency for review and approval.

**11B-703.1.1.2 Inspection.** Signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per *Chapter 1, Division II, Section 111*, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with these regulations.

**11B-703.2 Raised characters.** Raised characters shall comply with *Section 11B-703.2* and shall be duplicated in Braille complying with *Section 11B-703.3*. Raised characters shall be installed in accordance with *Section 11B-703.4*.

**11B-703.2.1 Depth.** Raised characters shall be  $\frac{1}{32}$  inch (0.8 mm) minimum above their background.

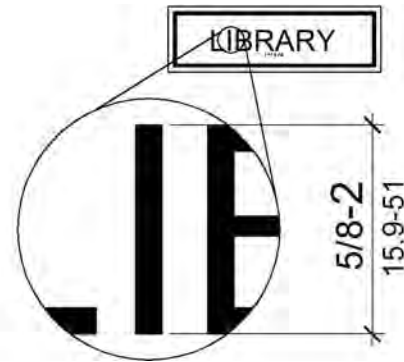
**11B-703.2.2 Case.** Characters shall be uppercase.

**11B-703.2.3 Style.** Characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.

**11B-703.2.4 Character proportions.** Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "T".

**11B-703.2.5 Character height.** Character height measured vertically from the baseline of the character shall be  $\frac{5}{8}$  inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter "T".

**Exception:** *Reserved.*



**FIGURE 11B-703.2.5  
HEIGHT OF RAISED CHARACTERS**

**11B-703.2.6 Stroke thickness.** Stroke thickness of the uppercase letter "T" shall be 15 percent maximum of the height of the character.

**11B-703.2.7 Character spacing.** Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be  $\frac{1}{8}$  inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be  $\frac{1}{16}$  inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and  $\frac{1}{8}$  inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements  $\frac{3}{8}$  inch (9.5 mm) minimum.

**11B-703.2.8 Line spacing.** Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

**11B-703.2.9 Format.** Text shall be in a horizontal format.

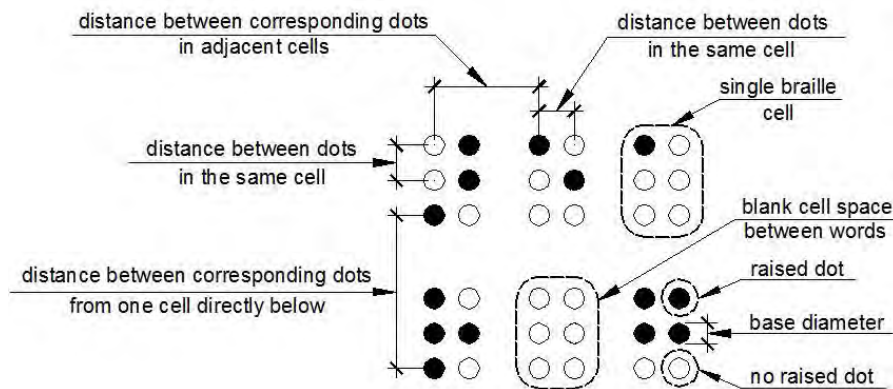
**11B-703.3 Braille.** Braille shall be contracted (Grade 2) and shall comply with *Sections 11B-703.3* and *11B-703.4*.

**11B-703.3.1 Dimensions and capitalization.** Braille dots shall have a domed or rounded shape and shall comply with *Table 11B-703.3.1*. The indication of an uppercase letter or letters shall only be used before the first word of

TABLE 11B-703.3.1  
BRAILLE DIMENSIONS

MEASUREMENT RANGE	MINIMUM IN INCHES MAXIMUM IN INCHES
Dot base diameter	0.059 (1.5 mm) to 0.063 (1.6 mm)
Distance between two dots in the same cell <sup>1</sup>	0.100 (2.5 mm)
Distance between corresponding dots in adjacent cells <sup>1</sup>	0.300 (7.6 mm)
Dot height	0.025 (0.6 mm) to 0.037 (0.9 mm)
Distance between corresponding dots from one cell directly below <sup>1</sup>	0.395 (10 mm) to 0.400 (10.2 mm)

1. Measured center to center.

FIGURE 11B-703.3.1  
BRAILLE MEASUREMENT

sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

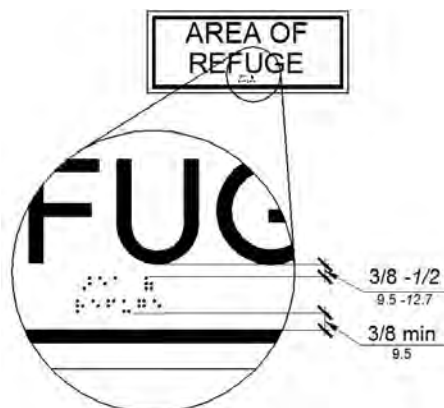
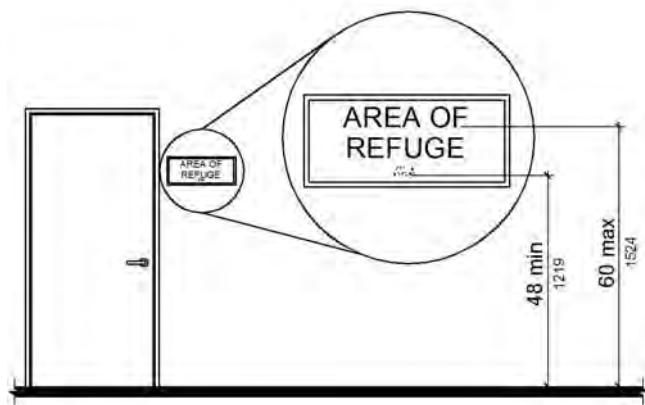
**11B-703.3.2 Position.** Braille shall be positioned below the corresponding text *in a horizontal format, flush left or centered*. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated  $\frac{3}{8}$  inch (9.5 mm) minimum and  $\frac{1}{2}$  inch (12.7 mm) maximum from any other tactile characters and  $\frac{3}{8}$  inch (9.5 mm) minimum from raised borders and decorative elements.

**Exception:** Braille provided on elevator car controls shall be separated  $\frac{3}{16}$  inch (4.8 mm) minimum and

shall be located either directly below the corresponding raised characters or symbols.

**11B-703.4 Installation height and location.** Signs with tactile characters shall comply with Section 11B-703.4.

**11B-703.4.1 Height above finish floor or ground.** Tactile characters on signs shall be located 48 inches (1219 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest *Braille cells* and 60 inches (1524 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest

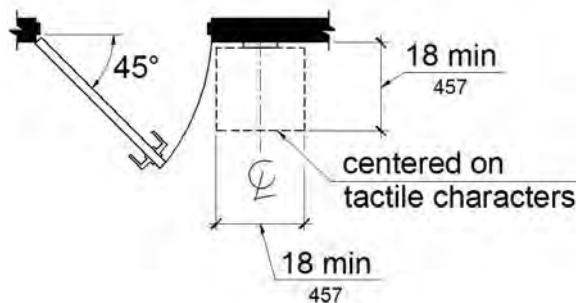
FIGURE 11B-703.3.2  
POSITION OF BRAILLEFIGURE 11B-703.4.1  
HEIGHT OF TACTILE CHARACTERS  
ABOVE FINISH FLOOR OR GROUND

line of raised characters.

**Exception:** Tactile characters for elevator car controls shall not be required to comply with *Section 11B-703.4.1*.

**11B-703.4.2 Location.** Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (457 mm) minimum by 18 inches (457 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. *Where permanent identification signage is provided for rooms and spaces they shall be located on the approach side of the door as one enters the room or space. Signs that identify exits shall be located on the approach side of the door as one exits the room or space.*

**Exception:** *Reserved.*



**FIGURE 11B-703.4.2**  
**LOCATION OF TACTILE SIGNS AT DOORS**

**11B-703.5 Visual characters.** Visual characters shall comply with *Section 11B-703.5*.

**Exception:** Where visual characters comply with *Section 11B-703.2* and are accompanied by Braille complying with *Section 11B-703.3*, they shall not be required to comply with *Sections 11B-703.5.2 through 11B-703.5.6, 11B-703.5.8 and 11B-703.5.9*.

**11B-703.5.1 Finish and contrast.** Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.

**11B-703.5.2 Case.** Characters shall be uppercase or lowercase or a combination of both.

**11B-703.5.3 Style.** Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.

**11B-703.5.4 Character proportions.** Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I".

**11B-703.5.5 Character height.** Minimum character height shall comply with Table 11B-703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the uppercase letter "I".

**Exception:** *Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with Section 11B-703.5.5.*

**11B-703.5.6 Height from finish floor or ground.** Visual characters shall be 40 inches (1016 mm) minimum above the finish floor or ground.

**Exceptions:**

1. Visual characters indicating elevator car controls shall not be required to comply with *Section 11B-703.5.6*.

**TABLE 11B-703.5.5**  
**VISUAL CHARACTER HEIGHT**

HEIGHT TO FINISH FLOOR OR GROUND FROM BASELINE OF CHARACTER	HORIZONTAL VIEWING DISTANCE	MINIMUM CHARACTER HEIGHT
40 inches (1016 mm) to less than or equal to 70 inches (1778 mm)	less than 72 inches (1829 mm)	$\frac{5}{8}$ inch (15.9 mm)
	72 inches (1829 mm) and greater	$\frac{5}{8}$ inch (15.9 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 72 inches (1829 mm)
Greater than 70 inches (1778 mm) to less than or equal to 120 inches (3048 mm)	less than 180 inches (4572 mm)	2 inches (51 mm)
	180 inches (4572 mm) and greater	2 inches (51 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 180 inches (4572 mm)
greater than 120 inches (3048 mm)	less than 21 feet (6401 mm)	3 inches (76 mm)
	21 feet (6401 mm) and greater	3 inches (76 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 21 feet (6401 mm)

2. Floor-level exit signs complying with Chapter 10, Section 1011.7 shall not be required to comply with Section 11B-703.5.6.
3. Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with Section 11B-703.5.6.

**11B-703.5.7 Stroke thickness.** Stroke thickness of the uppercase letter "P" shall be 10 percent minimum and 20 percent maximum of the height of the character.

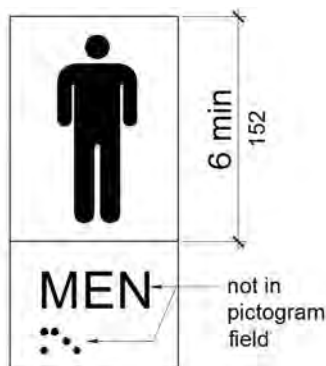
**11B-703.5.8 Character spacing.** Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of character height.

**11B-703.5.9 Line spacing.** Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height.

**11B-703.5.10 Format.** Text shall be in a horizontal format.

**11B-703.6 Pictograms.** Pictograms shall comply with Section 11B-703.6.

**11B-703.6.1 Pictogram field.** Pictograms shall have a field height of 6 inches (152 mm) minimum. Characters and Braille shall not be located in the pictogram field.



**FIGURE 11B-703.6.1  
PICTOGRAM FIELD**

**11B-703.6.2 Finish and contrast.** Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.

**11B-703.6.3 Text descriptors.** Pictograms shall have text descriptors located directly below the pictogram field. Text descriptors shall comply with Sections 11B-703.2, 11B-703.3 and 11B-703.4.

**11B-703.7 Symbols of accessibility.** Symbols of accessibility shall comply with Section 11B-703.7.

**11B-703.7.1 Finish and contrast.** Symbols of accessibility and their background shall have a non-glare finish. Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background.

#### **11B-703.7.2 Symbols**

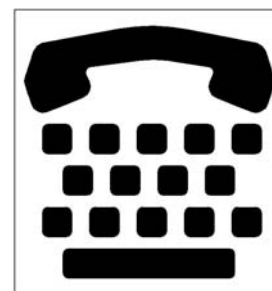
**11B-703.7.2.1 International Symbol of Accessibility.** The International Symbol of Accessibility shall comply with Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.

**Exception:** The appropriate enforcement agency may approve other colors to complement décor or unique design. The symbol contrast shall be light on dark or dark on light.



**FIGURE 11B-703.7.2.1  
INTERNATIONAL SYMBOL OF ACCESSIBILITY**

**11B-703.7.2.2 International Symbol of TTY.** The International Symbol of TTY shall comply with Figure 11B-703.7.2.2.



**FIGURE 11B-703.7.2.2  
INTERNATIONAL SYMBOL OF TTY**

**11B-703.7.2.3 Volume control telephones.** Telephones with a volume control shall be identified by a pictogram of a telephone handset with radiating sound waves on a square field such as shown in Figure 11B-703.7.2.3.



FIGURE 11B-703.7.2.3  
VOLUME CONTROL TELEPHONE

**11B-703.7.2.4 Assistive listening systems.** Assistive listening systems shall be identified by the International Symbol of Access for Hearing Loss complying with Figure 11B-703.7.2.4.



FIGURE 11B-703.7.2.4  
INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS

**11B-703.7.2.5 Cleaner Air Symbol.** Rooms, facilities and paths of travel that are accessible to and usable by people who are adversely impacted by airborne chemicals or particulate(s) and/or the use of electrical fixtures and/or devices shall be identified by the Cleaner Air Symbol complying with Figure 11B-703.7.2.5. This symbol is to be used strictly for publicly funded facilities or any facilities leased or rented by State of California, not concessionaires.



FIGURE 11B-703.7.2.5  
CLEANER AIR SYMBOL

The symbol, which shall include the text “Cleaner Air” as shown, shall be displayed either as a negative or positive image within a square that is a minimum of 6 inches (152 mm) on each side. The symbol may be shown in black and white or in color. When color is used, it shall be Federal Blue (Color No. 15090 Federal Standard 595B) on white, or white on Federal Blue. There shall be at least a 70-percent color contrast between the background of the sign from the surface that it is mounted on.

**11B-703.7.2.6 Toilet and bathing facilities geometric symbols.** Doorways leading to toilet rooms and bathing rooms shall be identified by a geometric symbol complying with Section 11B-703.7.2.6. The symbol shall be mounted at 58 inches (1473 mm) minimum and 60 inches (1524 mm) maximum above the finish floor or ground surface measured from the centerline of the symbol. Where a door is provided the symbol shall be mounted within 1 inch (25 mm) of the vertical centerline of the door.

**Exception:** Geometric symbols shall not be required at inmate toilet rooms and bathing rooms in detention and correctional facilities where only one gender is housed.

**11B-703.7.2.6.1 Men’s toilet and bathing facilities.** Men’s toilet and bathing facilities shall be identified by an equilateral triangle,  $\frac{1}{4}$  inch (6.4 mm) thick with edges 12 inches (305 mm) long and a vertex pointing upward. The triangle symbol shall contrast with the door, either light on a dark background or dark on a light background.

**Exception:** Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be  $\frac{1}{4}$  inch (6.4 mm) thick.

**11B-703.7.2.6.2 Women’s toilet and bathing facilities.** Women’s toilet and bathing facilities shall be identified by a circle,  $\frac{1}{4}$  inch (6.4 mm) thick and 12 inches (305 mm) in diameter. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background.

**Exception:** Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be  $\frac{1}{4}$  inch (6.4 mm) thick.

**11B-703.7.2.6.3 Unisex toilet and bathing facilities.** Unisex toilet and bathing facilities shall be identified by a circle,  $\frac{1}{4}$  inch (6.4 mm) thick and 12 inches (305 mm) in diameter with a  $\frac{1}{4}$  inch (6.4 mm) thick triangle with a vertex pointing upward superimposed on the circle and within the 12-inch (305 mm) diameter. The triangle symbol shall contrast with the circle symbol, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background.

**Exception:** Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be  $\frac{1}{4}$  inch (6.4 mm) thick.

**11B-703.7.2.6.4 Edges and corners.** Edges of signs shall be rounded, chamfered or eased. Corners of signs shall have a minimum radius of  $\frac{1}{8}$  inch (3.2 mm).

**11B-703.7.2.7 Pedestrian traffic-control buttons.** Pole-supported pedestrian traffic-control buttons shall be identified with color coding consisting of a textured horizontal yellow band 2 inches (51 mm) in width encircling the pole, and a 1-inch-wide (25 mm) dark border band above and below this yellow band. Color coding shall be placed immediately above the control button. Control buttons shall be located no higher than 48 inches (1219 mm) above the ground surface adjacent to the pole.

## 11B-704 Telephones

**11B-704.1 General.** Public telephones shall comply with Section 11B-704.

**11B-704.2 Wheelchair accessible telephones.** Wheelchair accessible telephones shall comply with Section 11B-704.2.

**11B-704.2.1 Clear floor or ground space.** A clear floor or ground space complying with Section 11B-305 shall be provided. The clear floor or ground space shall not be obstructed by bases, enclosures, or seats.

**11B-704.2.1.1 Parallel approach.** Where a parallel approach is provided, the distance from the edge of the telephone enclosure to the face of the telephone unit shall be 10 inches (254 mm) maximum.

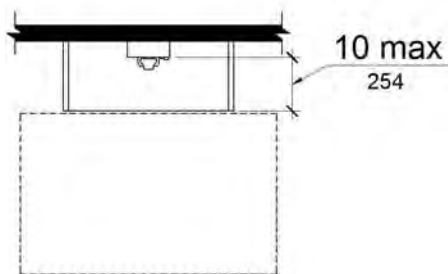


FIGURE 11B-704.2.1.1  
PARALLEL APPROACH TO TELEPHONE

**11B-704.2.1.2 Forward approach.** Where a forward approach is provided at a telephone within an enclosure, the counter may extend beyond the face of the telephone 20 inches (508 mm) into the required clear floor or ground space and the enclosure may extend beyond the face of the telephone 24 inches (610 mm). If an additional 6 inches (152 mm) in width of clear floor space is provided, creating a clear floor space of 36 inches by 48 inches (914 mm by 1219 mm), the enclosure may extend more than 24 inches (610 mm) beyond the face of the telephone.

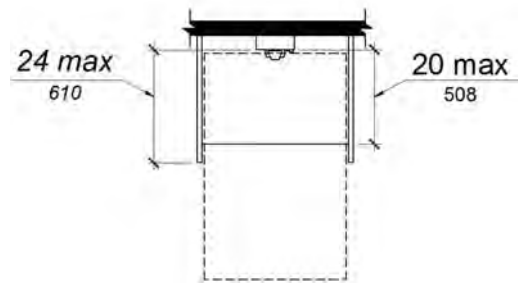


FIGURE 11B-704.2.1.2  
FORWARD APPROACH TO TELEPHONE

**11B-704.2.2 Operable parts.** Operable parts shall comply with Section 11B-309. Telephones shall have push-button controls where such service is available.

**11B-704.2.3 Telephone directories.** Telephone directories, where provided, shall be located in accordance with Section 11B-309.

**11B-704.2.4 Cord length.** The cord from the telephone to the handset shall be 29 inches (737 mm) long minimum.

**11B-704.3 Volume control telephones.** Public telephones required to have volume controls shall be equipped with a receive volume control that provides a gain adjustable up to 20 dB minimum. For incremental volume control, provide at least one intermediate step of 12 dB of gain minimum. An automatic reset shall be provided. *Volume control telephones shall be equipped with a receiver that generates a magnetic field in the area of the receiver cap. Public telephones with volume control shall be hearing aid compatible.*

**11B-704.4 TTYs.** TTYs provided at a public pay telephone shall be permanently affixed within, or adjacent to, the telephone enclosure. Where an acoustic coupler is used, the telephone cord shall be sufficiently long to allow connection of the TTY and the telephone receiver.

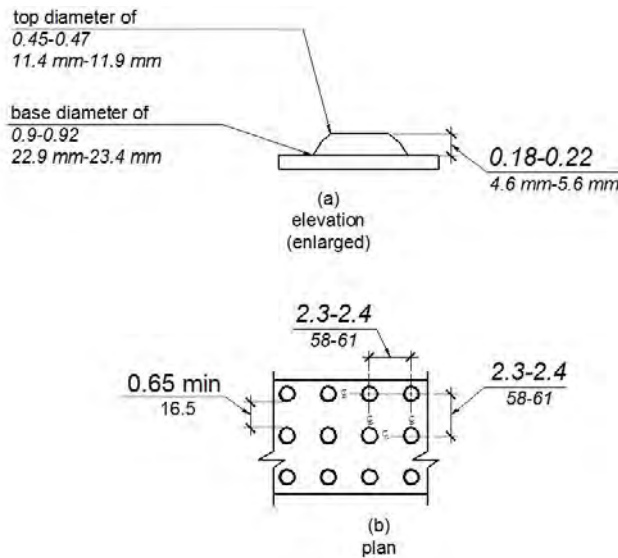
**11B-704.4.1 Height.** When in use, the touch surface of TTY keypads shall be 34 inches (864 mm) minimum above the finish floor.

**Exception:** Where seats are provided, TTYs shall not be required to comply with Section 11B-704.4.1.

**11B-704.5 TTY shelf.** Public pay telephones required to accommodate portable TTYs shall be equipped with a shelf and an electrical outlet within or adjacent to the telephone enclosure. The telephone handset shall be capable of being placed flush on the surface of the shelf. The shelf shall be capable of accommodating a TTY and shall have 6 inches (152 mm) minimum vertical clearance above the area where the TTY is to be placed.

**11B-705 Detectable warnings and detectable directional texture**



**11B-705.1 Detectable warnings**

**FIGURE 11B-705.1**  
**SIZE AND SPACING OF TRUNCATED DOMES**

**11B-705.1.1 General.** Detectable warnings shall consist of a surface of truncated domes and shall comply with Section 11B-705.

**11B-705.1.1.1 Dome size.** Truncated domes in a detectable warning surface shall have a base diameter of 0.9 inch (22.9 mm) minimum and 0.92 inch (23.4 mm) maximum, a top diameter of 0.45 inch (11.4 mm) minimum and 0.47 inch (11.9 mm) maximum, and a height of 0.18 inch (4.6 mm) minimum and 0.22 inch (5.6 mm) maximum.

**11B-705.1.1.2 Dome spacing.** Truncated domes in a detectable warning surface shall have a center-to-center spacing of 2.3 inches (58 mm) minimum and 2.4 inches (61 mm) maximum, and a base-to-base spacing of 0.65 inch (16.5 mm) minimum, measured between the most adjacent domes on a square grid.

**Exception:** Where installed in a radial pattern, truncated domes shall have a center-to-center spacing of 1.6 inches (41 mm) minimum to 2.4 inches (61 mm) maximum.

**11B-705.1.1.3 Contrast.** Detectable warning surfaces shall contrast visually with adjacent walking surfaces either light-on-dark, or dark-on-light. The material used to provide contrast shall be an integral part of the surface. Contrast shall be determined by:

$\text{Contrast} = [(B1-B2)/B1] \times 100 \text{ percent where}$

$B1$  = light reflectance value (LRV) of the lighter area and

$B2$  = light reflectance value (LRV) of the darker area.

**Exception:** Where the detectable warning surface does not adequately contrast with adjacent

surfaces, a 1 inch (25 mm) wide black strip shall separate yellow detectable warning from adjacent surfaces.

**11B-705.1.1.4 Resiliency.** Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact.

**Exception:** Detectable warning surfaces at curb ramps, islands or cut-through medians shall not be required to comply with Section 11B-705.1.1.4.

**11B-705.1.1.5 Color.** Detectable warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595C.

**Exception:** Detectable warning surfaces at curb ramps, islands or cut-through medians shall not be required to comply with Section 11B-705.1.1.5.

**11B-705.1.2 Locations.** Detectable warnings at the following locations shall comply with Section 11B-705.1.

**11B-705.1.2.1 Platform edges.** Detectable warning surfaces at platform boarding edges shall be 24 inches (610 mm) wide and shall extend the full length of the public use areas of the platform.

**11B-705.1.2.2 Curb ramps.** Detectable warnings at curb ramps shall extend 36 inches (914 mm) in the direction of travel. Detectable warnings shall extend the full width of the ramp run excluding any flared sides. Detectable warnings shall be located so the edge nearest the curb is 6 inches (152 mm) minimum and 8 inches (203 mm) maximum from the line at the face of the curb marking the transition between the curb and the gutter, street or highway.

**Exception:** On parallel curb ramps, detectable warnings shall be placed on the turning space at the flush transition between the street and sidewalk.

**11B-705.1.2.3 Islands or cut-through medians.** Detectable warnings at pedestrian islands or cut-through medians shall be 36 inches (914 mm) minimum in depth extending the full width of the pedestrian path or cut-through, placed at the edges of the pedestrian island or cut-through median, and shall be separated by 24 inches (610 mm) minimum of walking surface without detectable warnings.

**Exception:** Detectable warnings shall be 24 inches (610 mm) minimum in depth at pedestrian islands or cut-through medians that are less than 96 inches (2438 mm) in length in the direction of pedestrian travel.

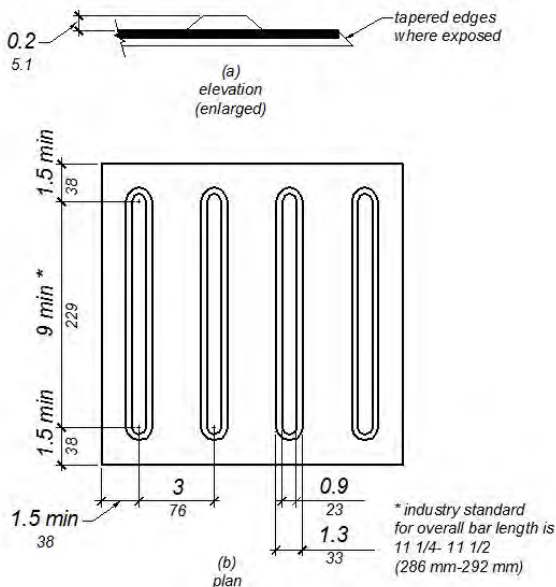
**11B-705.1.2.4 Bus stops.** When detectable warnings are provided at bus stop pads, it shall be 36 inches (914 mm) in width.

**11B-705.1.2.5 Hazardous vehicular areas.** Detectable warnings at hazardous vehicular areas shall be 36 inches (914 mm) in width.

**11B-705.1.2.6 Reflecting pools.** When detectable warnings are provided at reflecting pools, it shall be 24 inches (610 mm) minimum and 36 inches (914 mm) maximum in width.

**11B-705.1.2.7 Track crossings.** Detectable warnings at track crossings shall be 36 inches (914 mm) in the direction of pedestrian travel and extend the full width of the circulation path.

**11B-705.2 Detectable directional texture.** Detectable directional texture at transit boarding platforms shall comply with Figure 11B-705.2 and shall be 0.1 inch (2.5 mm) in height that tapers off to 0.04 inch (1.0 mm), with bars raised 0.2 inch (5.1 mm) from the surface. The raised bars shall be 1.3 inches (33 mm) wide and 3 inches (76 mm) from center-to-center of each bar. This surface shall differ from adjoining walking surfaces in resiliency or sound-on-cane contact. The color shall be yellow conforming to Federal Color No. 33538. This surface will be placed directly behind the yellow detectable warning texture specified in Section 11B-705.1.2.1, aligning with all doors of the transit vehicles where passengers will embark. The width of the directional texture shall be equal to the width of the transit vehicle's door opening. The depth of the texture shall not be less than 36 inches (914 mm).



**FIGURE 11B-705.2  
DETECTABLE DIRECTIONAL TEXTURE**

**11B-705.3 Product approval.** Only approved DSA-AC detectable warning products and directional surfaces shall be installed as provided in the California Code of Regulations (CCR), Title 24, Part 1, Chapter 5, Articles 2, 3 and 4. Refer to CCR Title 24, Part 12, Chapter 11B, Section 12-11B.205 for building and facility access specifications for product approval for detectable warning products and directional surfaces.

#### **11B-706 Assistive listening systems**

**11B-706.1 General.** Assistive listening systems required in assembly areas, conference and meeting rooms shall comply with Section 11B-706.

**11B-706.2 Receiver jacks.** Receivers required for use with an assistive listening system shall include a  $\frac{1}{8}$  inch (3.2 mm) standard mono jack.

**11B-706.3 Receiver hearing-aid compatibility.** Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.

**11B-706.4 Sound pressure level.** Assistive listening systems shall be capable of providing a sound pressure level of 110 dB minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB.

**11B-706.5 Signal-to-noise ratio.** The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18 dB minimum.

**11B-706.6 Peak clipping level.** Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech.

#### **11B-707 Automatic teller machines, fare machines and point-of-sale devices**

**11B-707.1 General.** Automatic teller machines, fare machines and point-of-sale devices shall comply with Section 11B-707.

**11B-707.2 Clear floor or ground space.** A clear floor or ground space complying with Section 11B-305 shall be provided.

**Exception:** Clear floor or ground space shall not be required at drive-up only automatic teller machines and fare machines.

**11B-707.3 Operable parts.** Operable parts shall comply with Section 11B-309. Unless a clear or correct key is provided, each operable part shall be able to be differentiated by sound or touch, without activation.

**Exception:** Drive-up only automatic teller machines and fare machines shall not be required to comply with Sections 11B-309.2 and 11B-309.3.

**11B-707.4 Privacy.** Automatic teller machines shall provide the opportunity for the same degree of privacy of input and output available to all individuals.

**11B-707.5 Speech output.** Machines shall be speech enabled. Operating instructions and orientation, visible transaction prompts, user input verification, error messages, and all displayed information for full use shall be accessible to and independently usable by individuals with vision impairments. Speech shall be delivered through a mechanism that is readily available to all users, including but not limited to, an industry standard connector or a telephone handset. Speech shall be recorded or digitized human, or synthesized.

#### **Exceptions:**

1. Audible tones shall be permitted instead of speech for visible output that is not displayed for security purposes, including but not limited to, asterisks representing personal identification numbers.
2. Advertisements and other similar information shall not be required to be audible unless they convey information that can be used in the transaction being conducted.
3. Where speech synthesis cannot be supported, dynamic alphabetic output shall not be required to be audible.

**11B-707.5.1 User control.** Speech shall be capable of being repeated or interrupted. Volume control shall be provided for the speech function.

**Exception:** Speech output for any single function shall be permitted to be automatically interrupted when a transaction is selected.

**11B-707.5.2 Receipts.** Where receipts are provided, speech output devices shall provide audible balance inquiry information, error messages, and all other information on the printed receipt necessary to complete or verify the transaction.

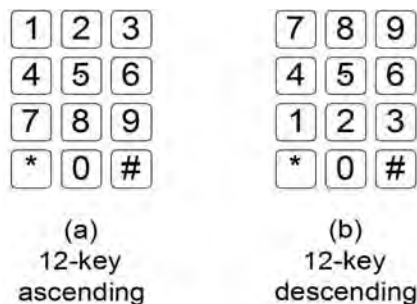
**Exceptions:**

1. Machine location, date and time of transaction, customer account number, and the machine identifier shall not be required to be audible.
2. Information on printed receipts that duplicates information available on-screen shall not be required to be presented in the form of an audible receipt.
3. Printed copies of bank statements and checks shall not be required to be audible.

**11B-707.6 Input.** Input devices shall comply with Section 11B-707.6.

**11B-707.6.1 Input controls.** At least one tactilely discernible input control shall be provided for each function. Where provided, key surfaces not on active areas of display screens, shall be raised above surrounding surfaces. Where membrane keys are the only method of input, each shall be tactilely discernible from surrounding surfaces and adjacent keys.

**11B-707.6.2 Numeric keys.** Numeric keys shall be arranged in a 12-key ascending or descending telephone keypad layout. The number five key shall be tactilely distinct from the other keys.



**FIGURE 11B-707.6.2  
NUMERIC KEY LAYOUT**

**11B-707.6.3 Function keys.** Function keys shall comply with Section 11B-707.6.3.

**11B-707.6.3.1 Contrast.** Function keys shall contrast visually from background surfaces. Characters and symbols on key surfaces shall contrast visually from key surfaces. Visual contrast shall be either light-on-dark or dark-on-light.

**Exception:** Tactile symbols required by Section 11B-707.6.3.2 shall not be required to comply with Section 11B-707.6.3.1.

**11B-707.6.3.2 Tactile symbols.** Function key surfaces shall have tactile symbols as follows: Enter or Proceed key: raised circle; Clear or Correct key: raised left arrow; Cancel key: raised letter ex; Add Value key: raised plus sign; Decrease Value key: raised minus sign.

**11B-707.7 Display screen.** The display screen shall comply with Section 11B-707.7.

**Exception:** Drive-up only automatic teller machines and fare machines shall not be required to comply with Section 11B-707.7.1.

**11B-707.7.1 Visibility.** The display screen shall be visible from a point located 40 inches (1016 mm) above the center of the clear floor space in front of the machine.

**11B-707.7.1.1 Vertically mounted display screen.** Where display screens are mounted vertically or no more than 30 degrees tipped away from the viewer, the center line of the display screen and other display devices shall be no more than 52 inches (1321 mm) above the floor or ground surface.

**11B-707.7.1.2 Angle-mounted display screen.** Where display screens are mounted between 30 degrees and 60 degrees tipped away from the viewer, the center line of the display screen and other display devices shall be no more than 44 inches (1118 mm) above the floor or ground surface.

**11B-707.7.1.3 Horizontally mounted display screen.** Where display screens are mounted no less than 60 degrees and no more than 90 degrees (horizontal) tipped away from the viewer, the center line of the display screen and other display devices shall be no more than 34 inches (864 mm) above the floor or ground surface.

**11B-707.7.2 Characters.** Characters displayed on the screen shall be in a sans serif font. Characters shall be  $\frac{3}{16}$  inch (4.8 mm) high minimum based on the uppercase letter "I". Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.

**11B-707.8 Braille instructions.** Braille instructions for initiating the speech mode shall be provided. Braille shall comply with Section 11B-703.3.

**11B-707.9 Point-of-sale devices.** Point-of-sale devices shall comply with Section 11B-707.9.

**11B-707.9.1 General.** Where point-of-sale devices are provided, all devices at each location shall comply with Sections 11B-309.4, 11B-707.3 and 11B-707.7.2. In addition, point-of-sale systems that include a video touch screen or any other non-tactile keypad shall be equipped with either of the following:

**11B-707.9.1.1 Tactilely discernible numerical keypad.** A tactilely discernible numerical keypad similar to a telephone keypad containing a raised dot with a dot

base diameter between 1.5 mm and 1.6 mm and a height between 0.6 mm and 0.9 mm on the number 5 key that enables a visually impaired person to enter his or her own personal identification number or any other personal information necessary to process the transaction in a manner that provides the opportunity for the same degree of privacy input and output available to all individuals.

**11B-707.9.1.2 Other technology.** Other technology, such as a radio frequency identification device, fingerprint biometrics, or some other mechanism that enables a visually impaired person to access the video touch screen device with his or her personal identifier and to process his or her transaction in a manner that provides the opportunity for the same degree of privacy input and output available to all individuals. Where a video screen overlay is provided it shall be equipped with a tactilely discernible numerical keypad complying with Section 11B-707.9.1.1.

**11B-707.9.2 Point-of-sale devices at check stands and sales or service counters.** Where point-of-sale devices are provided at check stands and sales or service counters, they shall comply with Section 11B-707.9.1, and shall also comply with Sections 11B-707.2, 11B-707.3 and 11B-707.4.

## **11B-708 Two-way communication systems**

**11B-708.1 General.** Two-way communication systems shall comply with Section 11B-708.

**11B-708.2 Audible and visual indicators.** The system shall provide both audible and visual signals.

**11B-708.3 Handsets.** Handset cords, if provided, shall be 29 inches (737 mm) long minimum.

**11B-708.4 Residential dwelling unit communication systems.** Communications systems between a residential dwelling unit and a site, building, or floor entrance shall comply with Section 11B-708.4.

**11B-708.4.1 Common use or public use system interface.** The common use or public use system interface shall include the capability of supporting voice and TTY communication with the residential dwelling unit interface.

**11B-708.4.2 Residential dwelling unit interface.** The residential dwelling unit system interface shall include a telephone jack capable of supporting voice and TTY communication with the common use or public use system interface.

## DIVISION 8: SPECIAL ROOMS, SPACES, AND ELEMENTS

### 11B-801 General

**11B-801.1 Scope.** The provisions of *Division 8* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-802 Wheelchair spaces, companion seats, and designated aisle seats and semi-ambulant seats

**11B-802.1 Wheelchair spaces.** Wheelchair spaces shall comply with *Section 11B-802.1*.

**11B-802.1.1 Floor or ground surface.** The floor or ground surface of wheelchair spaces shall comply with *Section 11B-302*. Changes in level are not permitted.

**Exception:** Slopes not steeper than 1:48 shall be permitted.

**11B-802.1.2 Width.** A single wheelchair space shall be 36 inches (914 mm) wide minimum. Where two adjacent wheelchair spaces are provided, each wheelchair space shall be 33 inches (838 mm) wide minimum.

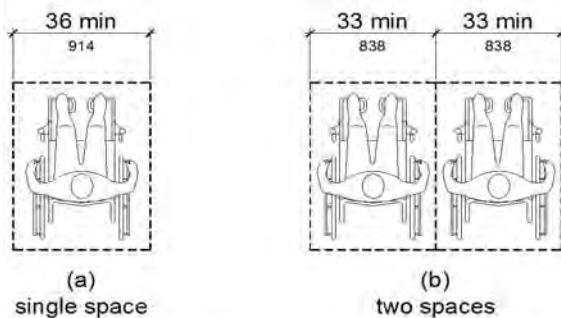


FIGURE 11B-802.1.2  
WIDTH OF WHEELCHAIR SPACES

**11B-802.1.3 Depth.** Where a wheelchair space can be entered from the front or rear, the wheelchair space shall be 48 inches (1219 mm) deep minimum. Where a wheelchair space can be entered only from the side, the wheelchair space shall be 60 inches (1524 mm) deep minimum.

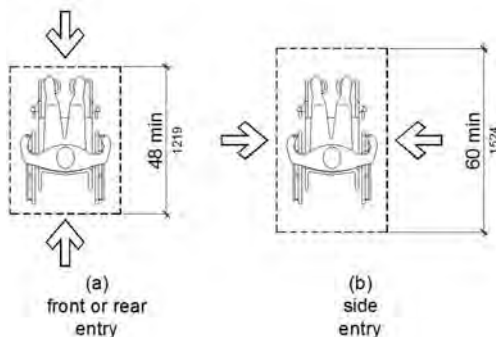


FIGURE 11B-802.1.3  
DEPTH OF WHEELCHAIR SPACES

**11B-802.1.4 Approach.** Wheelchair spaces shall adjoin accessible routes. Accessible routes shall not overlap wheelchair spaces.

**11B-802.1.5 Overlap.** Wheelchair spaces shall not overlap circulation paths.

**11B-802.2 Lines of sight.** Lines of sight to the screen, performance area, or playing field for spectators in wheelchair spaces shall comply with *Section 11B-802.2*.

**11B-802.2.1 Lines of sight over seated spectators.** Where spectators are expected to remain seated during events, spectators in wheelchair spaces shall be afforded lines of sight complying with *Section 11B-802.2.1*.

**11B-802.2.1.1 Lines of sight over heads.** Where spectators are provided lines of sight over the heads of spectators seated in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the heads of seated spectators in the first row in front of wheelchair spaces.

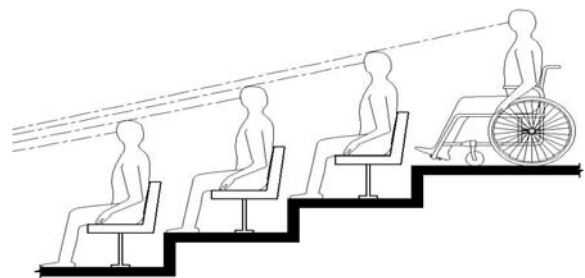


FIGURE 11B-802.2.1.1  
LINES OF SIGHT OVER THE HEADS OF SEATED SPECTATORS

**11B-802.2.1.2 Lines of sight between heads.** Where spectators are provided lines of sight over the shoulders and between the heads of spectators seated in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the shoulders and between the heads of seated spectators in the first row in front of wheelchair spaces.

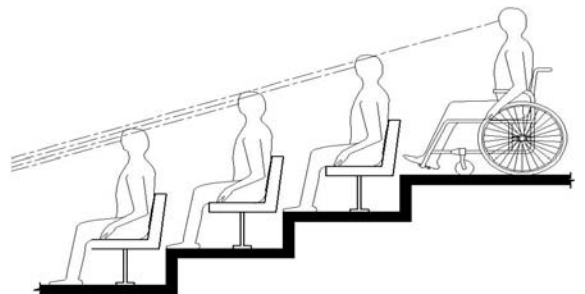
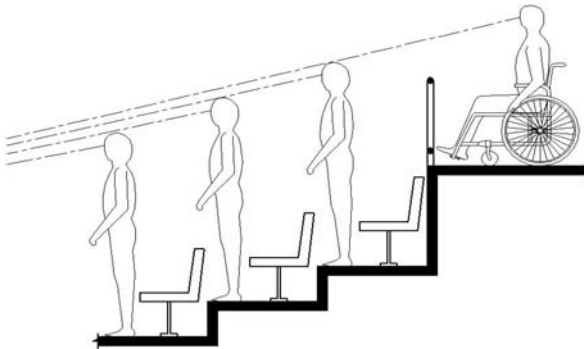


FIGURE 11B-802.2.1.2  
LINES OF SIGHT BETWEEN THE  
HEADS OF SEATED SPECTATORS

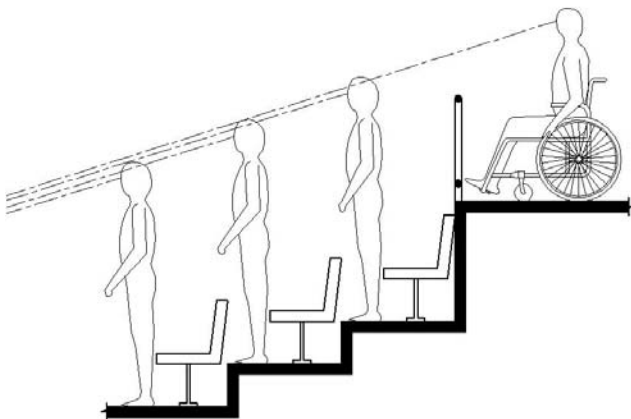
**11B-802.2.2 Lines of sight over standing spectators.** Where spectators are expected to stand during events, spectators in wheelchair spaces shall be afforded lines of sight complying with *Section 11B-802.2.2*.

**11B-802.2.2.1 Lines of sight over heads.** Where standing spectators are provided lines of sight over the heads of spectators standing in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the heads of standing spectators in the first row in front of wheelchair spaces.



**FIGURE 11B-802.2.2.1  
LINES OF SIGHT OVER THE  
HEADS OF STANDING SPECTATORS**

**11B-802.2.2.2 Lines of sight between heads.** Where standing spectators are provided lines of sight over the shoulders and between the heads of spectators standing in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the shoulders and between the heads of standing spectators in the first row in front of wheelchair spaces.



**FIGURE 11B-802.2.2.2  
LINES OF SIGHT BETWEEN THE  
HEADS OF STANDING SPECTATORS**

**11B-802.3 Companion seats.** Companion seats shall comply with *Section 11B-802.3*.

**11B-802.3.1 Alignment.** In row seating, companion seats shall be located to provide shoulder alignment with adjacent wheelchair spaces. The shoulder alignment point of the wheelchair space shall be measured 36 inches (914 mm) from the front of the wheelchair space. The floor surface of the companion seat shall be at the same elevation as the floor surface of the wheelchair space.

**11B-802.3.2 Type.** Companion seats shall be equivalent in size, quality, comfort, and amenities to the seating in the immediate area. Companion seats shall be permitted to be movable.

**11B-802.4 Designated aisle seats.** Designated aisle seats shall comply with *Section 11B-802.4*.

**11B-802.4.1 Armrests.** Where armrests are provided on the seating in the immediate area, folding or retractable armrests shall be provided on the aisle side of the seat.

**11B-802.4.2 Identification.** Each designated aisle seat shall be identified by a sign or marker with the *International Symbol of Accessibility* complying with *Section 11B-703.7.2.1*. Signage complying with *Section 11B-703.5*, notifying patrons of the availability of such seats shall be posted at the ticket office.

**11B-802.5 Semi-ambulant seats.** Semi-ambulant seats shall provide at least 24 inches (610 mm) clear leg space between the front of the seat to the nearest obstruction or to the back of the seat immediately in front.

### **11B-803 Dressing, fitting, and locker rooms**

**11B-803.1 General.** Dressing, fitting and locker rooms shall comply with *Section 11B-803*.

**11B-803.2 Turning space.** Turning space complying with *Section 11B-304* shall be provided within the room.

**11B-803.3 Door swing.** Doors shall not swing into the room unless a turning space complying with *Section 11B-304.3* is provided beyond the arc of the door swing.

**11B-803.4 Benches.** A bench complying with *Section 11B-903* shall be provided within the room.

**11B-803.5 Coat hooks and shelves.** Coat hooks provided within the room shall be located within one of the reach ranges specified in *Section 11B-308*. Shelves shall be 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor or ground. Coat hooks shall not be located above the bench or other seating in the room.

**11B-803.6 Mirrors.** Mirrors shall be installed with the bottom edge of the reflecting surface 20 inches (508 mm) maximum above the finish floor or ground. Mirrors shall be full length with a reflective surface 18 inches (457 mm) wide minimum by 54 inches (1372 mm) high minimum and shall be mounted in a position affording a view to a person on the bench as well as to a person in a standing position.

### **11B-804 Kitchens and kitchenettes**

**11B-804.1 General.** Kitchens and kitchenettes shall comply with *Section 11B-804*.

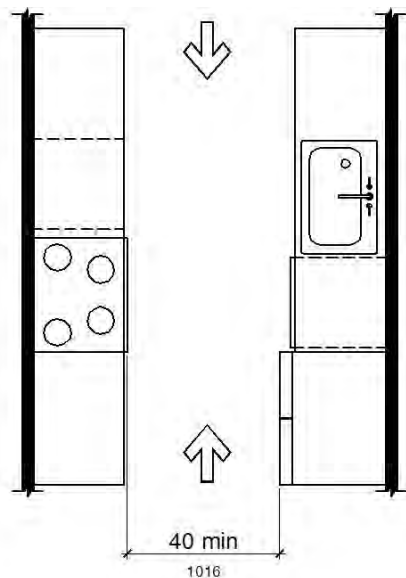
**11B-804.2 Clearance.** Where a pass through kitchen is provided, clearances shall comply with *Section 11B-804.2.1*.



Where a U-shaped kitchen is provided, clearances shall comply with *Section 11B-804.2.2*.

**Exception:** Spaces that do not provide a cooktop or conventional range shall not be required to comply with *Section 11B-804.2*.

**11B-804.2.1 Pass through kitchen.** In pass through kitchens where counters, appliances or cabinets are on two opposing sides, or where counters, appliances or cabinets are opposite a parallel wall, clearance between all opposing base cabinets, counter tops, appliances, or walls within kitchen work areas shall be 40 inches (1016 mm) minimum. Pass through kitchens shall have two entries.



**FIGURE 11B-804.2.1**  
**PASS THROUGH KITCHENS**

**11B-804.2.2 U-shaped.** In U-shaped kitchens enclosed on three contiguous sides, clearance between all opposing base cabinets, counter tops, appliances, or walls within kitchen work areas shall be 60 inches (1524 mm) minimum.

**11B-804.3 Kitchen work surface.** In residential dwelling units required to comply with *Section 11B-809*, at least one 30 inches (762 mm) wide minimum section of counter shall provide a kitchen work surface that complies with *Section 11B-804.3*.

**11B-804.3.1 Clear floor or ground space.** A clear floor space complying with *Section 11B-305* positioned for a forward approach shall be provided. The clear floor or ground space shall be centered on the kitchen work surface and shall provide knee and toe clearance complying with *Section 11B-306*.

**Exception:** Cabinetry shall be permitted under the kitchen work surface provided that all of the following conditions are met:

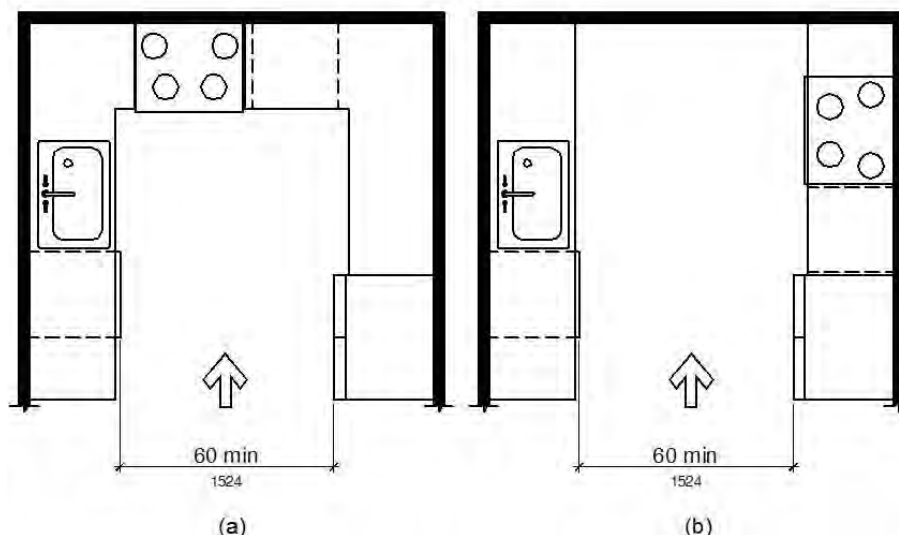
- (a) the cabinetry can be removed without removal or replacement of the kitchen work surface;
- (b) the finish floor extends under the cabinetry; and
- (c) the walls behind and surrounding the cabinetry are finished.

**11B-804.3.2 Height.** The kitchen work surface shall be 34 inches (864 mm) maximum above the finish floor or ground.

**Exception:** A counter that is adjustable to provide a kitchen work surface at variable heights, 29 inches (737 mm) minimum and 36 inches (914 mm) maximum, shall be permitted.

**11B-804.3.3 Exposed surfaces.** There shall be no sharp or abrasive surfaces under the work surface counters.

**11B-804.4 Sinks.** Sinks shall comply with *Section 11B-606*.



**FIGURE 11B-804.2.2**  
**U-SHAPED KITCHENS**

**11B-804.5 Storage.** At least 50 percent of shelf space in storage facilities shall comply with *Section 11B-811*.

**11B-804.6 Appliances.** Where provided, kitchen appliances shall comply with *Section 11B-804.6*.

**11B-804.6.1 Clear floor or ground space.** A clear floor or ground space complying with *Section 11B-305* shall be provided at each kitchen appliance. Clear floor or ground spaces shall be permitted to overlap.

**11B-804.6.2 Operable parts.** All appliance controls shall comply with *Section 11B-309*.

**Exceptions:**

1. Appliance doors and door latching devices shall not be required to comply with *Section 11B-309.4*.
2. Bottom-hinged appliance doors, when in the open position, shall not be required to comply with *Section 11B-309.3*.

**11B-804.6.3 Dishwasher.** Clear floor or ground space shall be positioned adjacent to the dishwasher door. The dishwasher door, in the open position, shall not obstruct the clear floor or ground space for the dishwasher or the sink.

**11B-804.6.4 Range or cooktop.** Where a forward approach is provided, the clear floor or ground space shall provide knee and toe clearance complying with *Section 11B-306*. Where knee and toe space is provided, the underside of the range or cooktop shall be insulated or otherwise configured to prevent burns, abrasions, or electrical shock. The location of controls shall not require reaching across burners.

**11B-804.6.5 Oven.** Ovens shall comply with *Section 11B-804.6.5*.

**11B-804.6.5.1 Side-hinged door ovens.** Side-hinged door ovens shall have the work surface required by *Section 11B-804.3* positioned adjacent to the latch side of the oven door.

**11B-804.6.5.2 Bottom-hinged door ovens.** Bottom-hinged door ovens shall have the work surface required by *Section 11B-804.3* positioned adjacent to one side of the door.

**11B-804.6.5.3 Controls.** Ovens shall have controls on front panels.

**11B-804.6.6 Refrigerator/freezer.** Combination refrigerators and freezers shall have at least 50 percent of the freezer space 54 inches (1372 mm) maximum above the finish floor or ground. The clear floor or ground space shall be positioned for a parallel approach to the space dedicated to a refrigerator/freezer with the centerline of the clear floor or ground space offset 24 inches (610 mm) maximum from the centerline of the dedicated space.

**11B-805 Medical care and long-term care facilities**

**11B-805.1 General.** Medical care facilities and long-term care facilities shall comply with *Section 11B-805*. All common use spaces and public use spaces in medical care facilities

and long-term care facilities shall comply with this chapter.

**11B-805.2 Patient bedrooms and resident sleeping rooms.** Patient bedrooms and resident sleeping rooms required to provide mobility features shall comply with *Section 11B-805.2*.

**11B-805.2.1 Hand washing fixtures.** Hand washing fixtures shall comply with *Section 11B-606*.

**11B-805.2.2 Beds.** A 36 inch (914 mm) minimum wide clear space shall be provided along the full length of each side of the beds.

**11B-805.2.3 Turning space.** Turning space complying with *Section 11B-304* shall be provided within the room.

**11B-805.2.4 Toilet and bathing rooms.** Toilet and bathing rooms that are provided as part of patient bedrooms and resident sleeping rooms complying with *Section 11B-223.2* or *11B-223.3* shall comply with *Section 11B-603*. Where provided, one water closet, one lavatory, and one bathtub or shower shall comply with the applicable requirements of *Sections 11B-603* through *11B-610*.

**11B-805.3 Waiting rooms.** Waiting rooms shall comply with *Section 11B-805.3*.

**11B-805.3.1 Wheelchair spaces.** Where seating is provided in waiting rooms, at least 5 percent of the seating shall be wheelchair spaces complying with *Section 11B-802.1*.

**Exception:** In waiting rooms serving facilities specializing in treating conditions that affect mobility, 10 percent of the seating shall be wheelchair spaces complying with *Section 11B-802.1*.

**11B-805.4 Examination, diagnostic and treatment rooms.** Examination, diagnostic and treatment rooms shall comply with *Section 11B-805.4*.

**11B-805.4.1 Beds, exam tables, procedure tables, gurneys and lounge chairs.** A 36-inch (914 mm) minimum wide clear space shall be provided along the full length of each side of beds, exam tables, procedure tables, gurneys and lounge chairs.

**Exception:** General exam rooms in non-emergency settings may provide clear space on only one side of beds, gurneys and exam tables.

**11B-805.4.2 Equipment.** Clear space complying with *Section 11B-305.2* shall be provided as required for specific equipment.

**11B-805.4.3 Turning space.** Turning space complying with *Section 11B-304* shall be provided within the room.

**11B-805.5 Patient change areas.** Areas where patients change or are prepared for a procedure shall comply with *Section 11B-222*.

**11B-805.6 Hand washing fixtures, lavatories and sinks.** All hand washing fixtures, lavatories and sinks shall comply with *Section 11B-606*.

**Exception:** Scrub sinks, as defined in California Plumbing Code *Section 221.0*, shall not be required to comply with *Section 11B-606*.



**11B-805.7 Built-in cabinets and work surfaces.** Built-in cabinets, counters and work surfaces shall be accessible, including: patient wardrobes, nurse's stations, administrative centers, reception desks, medicine preparation areas, laboratory work stations, equipment consoles, clean and soiled utility cabinets, and storage areas; and shall comply with Sections 11B-225 and 11B-902.

**Exceptions:**

1. Built-in wardrobes in patient bedrooms and resident sleeping rooms not required to be accessible are not required to comply with the provisions of this chapter.
2. Clinical laboratory work stations provided in a laboratory area that are in addition to the minimum number required to be accessible (5 percent of the work stations provided, but no fewer than one), are not required to comply with the provisions of Section 11B-902.

**11B-806 Transient lodging guest rooms**

**11B-806.1 General.** Transient lodging guest rooms shall comply with Section 11B-806. Guest rooms required to provide mobility features shall comply with Section 11B-806.2. Guest rooms required to provide communication features shall comply with Section 11B-806.3.

**11B-806.2 Guest rooms with mobility features.** Guest rooms required to provide mobility features shall comply with Section 11B-806.2.

**11B-806.2.1 Living and dining areas.** Living and dining areas shall be accessible.

**11B-806.2.2 Exterior spaces.** Exterior spaces, including patios, terraces and balconies, that serve the guest room shall be accessible.

**11B-806.2.3 Sleeping areas.** At least one sleeping area shall provide a 36 inch (914 mm) by 48 inch (1219 mm) minimum clear space on both sides of a bed. The clear space shall be positioned for parallel approach to the side of the bed.

**Exception:** Where a single clear floor space complying with Section 11B-305 positioned for parallel approach is provided between two beds, a clear floor or ground space shall not be required on both sides of a bed.

**11B-806.2.3.1 Personal lift device floor space.** There shall be a clear space under the bed for the use of a personal lift device. The clear space shall extend under the bed parallel to the long side and be adjacent to an accessible route. The clear space shall extend to points horizontally 30 inches (762 mm), vertically 7 inches (178 mm) and not more than 12 inches (305 mm) from the head and foot end of the bed.

**11B-806.2.4 Toilet and bathing facilities.** At least one bathroom that is provided as part of a guest room shall comply with Section 11B-603. No fewer than one water closet, one lavatory, and one bathtub or shower shall comply with applicable requirements of Sections 11B-603 through 11B-610. In addition, required roll-in shower

compartments shall comply with Section 11B-608.2.2 or 11B-608.2.3. Toilet and bathing fixtures required to comply with Sections 11B-603 through 11B-610 shall be permitted to be located in more than one toilet or bathing area, provided that travel between fixtures does not require travel between other parts of the guest room.

**11B-806.2.4.1 Vanity counter top space.** If vanity counter top space is provided in non-accessible guest toilet or bathing rooms, comparable vanity counter top space, in terms of size and proximity to the lavatory, shall also be provided in accessible guest toilet or bathing rooms.

**11B-806.2.5 Kitchens, kitchenettes and wet bars.** Kitchens, kitchenettes and wet bars shall comply with Section 11B-804.

**11B-806.2.6 Turning space.** Turning space complying with Section 11B-304 shall be provided within the guest room.

**11B-806.3 Guest rooms with communication features.** Guest rooms required to provide communication features shall comply with Section 11B-806.3.

**11B-806.3.1 Alarms.** Where emergency warning systems are provided, alarms complying with Section 11B-702 shall be provided.

**11B-806.3.2 Notification devices.** Visible notification devices shall be provided to alert room occupants of incoming telephone calls and a door knock or bell. Notification devices shall not be connected to visible alarm signal appliances. Telephones shall have volume controls compatible with the telephone system and shall comply with Section 11B-704.3. Telephones shall be served by an electrical outlet complying with Section 11B-309 located within 48 inches (1219 mm) of the telephone to facilitate the use of a TTY.

**11B-807 Holding cells and housing cells**

**11B-807.1 General.** Holding cells and housing cells shall comply with Section 11B-807.

**11B-807.2 Cells with mobility features.** Cells required to provide mobility features shall comply with Section 11B-807.2.

**11B-807.2.1 Turning space.** Turning space complying with Section 11B-304 shall be provided within the cell.

**11B-807.2.2 Benches.** Where benches are provided, at least one bench shall comply with Section 11B-903.

**11B-807.2.3 Beds.** Where beds are provided, clear floor space complying with Section 11B-305 shall be provided on at least one side of the bed. The clear floor space shall be positioned for parallel approach to the side of the bed.

**11B-807.2.4 Toilet and bathing facilities.** Toilet facilities or bathing facilities that are provided as part of a cell shall comply with Section 11B-603. Where provided, no fewer than one water closet, one lavatory, and one bathtub or shower shall comply with the applicable requirements of Sections 11B-603 through 11B-610.

**11B-807.3 Cells with communication features.** Cells required to provide communication features shall comply with *Section 11B-807.3*.

**11B-807.3.1 Alarms.** Where audible emergency alarm systems are provided to serve the occupants of cells, visible alarms complying with *Section 11B-702* shall be provided.

**Exception:** Visible alarms shall not be required where inmates or detainees are not allowed independent means of egress.

**11B-807.3.2 Telephones.** Telephones, where provided within cells, shall have volume controls complying with *Section 11B-704.3*.

## **11B-808 Courtrooms**

**11B-808.1 General.** Courtrooms shall comply with *Section 11B-808*.

**11B-808.2 Turning space.** Where provided, areas that are raised or depressed and accessed by ramps or platform lifts with entry ramps shall provide unobstructed turning space complying with *Section 11B-304*.

**11B-808.3 Clear floor space.** Each jury box and witness stand shall have, within its defined area, clear floor space complying with *Section 11B-305*.

**Exception:** In alterations, wheelchair spaces are not required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where ramp or platform lift access poses a hazard by restricting or projecting into a means of egress required by the appropriate administrative authority.

**11B-808.4 Judges' benches and courtroom stations.** Judges' benches, clerks' stations, bailiffs' stations, deputy clerks' stations, court reporters' stations and litigants' and counsel stations shall comply with *Section 11B-902*.

## **11B-809 Residential dwelling units**

**11B-809.1 General.** When located within public housing facilities, residential dwelling units shall comply with *Section 11B-809*. Residential dwelling units required to provide mobility features shall comply with *Sections 11B-809.2* through *11B-809.4*. Residential dwelling units required to provide communication features shall comply with *Section 11B-809.5*.

**11B-809.2 Accessible routes.** Accessible routes complying with *Division 4* shall be provided within residential dwelling units in accordance with *Section 11B-809.2*.

**Exception:** Accessible routes shall not be required to or within unfinished attics or unfinished basements.

**11B-809.2.1 Location.** At least one accessible route shall connect all spaces and elements which are a part of the residential dwelling unit. Where only one accessible route is provided, it shall not pass through bathrooms, closets, or similar spaces.

**11B-809.2.2 Turning space.** All rooms served by an accessible route shall provide a turning space complying with *Section 11B-304*.

**Exception:** Turning space shall not be required in exterior spaces 30 inches (762 mm) maximum in depth or width.

**11B-809.3 Kitchen.** Where a kitchen is provided, it shall comply with *Section 11B-804*.

**11B-809.4 Toilet facilities and bathing facilities.** At least one bathroom shall comply with *Section 11B-603*. No fewer than one of each type of fixture provided within the bathroom shall comply with applicable requirements of *Sections 11B-603* through *11B-610*. Toilet and bathing fixtures required to comply with *Sections 11B-603* through *11B-610* shall be located in the same bathroom or toilet and bathing area, such that travel between fixtures does not require travel between other parts of the residential dwelling unit.

**11B-809.4.1 Subsequent bathrooms.** In residential dwelling units with more than one bathroom, when a bathtub is installed in the first bathroom in compliance with *Section 11B-809.4* and a shower compartment is provided in a subsequent bathroom, at least one shower compartment shall comply with *Section 11B-608*.

**11B-809.5 Residential dwelling units with communication features.** Residential dwelling units required to provide communication features shall comply with *Section 11B-809.5*.

**11B-809.5.1 Building fire alarm system.** Where a building fire alarm system is provided, the system wiring shall be extended to a point within the residential dwelling unit in the vicinity of the residential dwelling unit smoke detection system.

**11B-809.5.1.1 Alarm appliances.** Where alarm appliances are provided within a residential dwelling unit as part of the building fire alarm system, they shall comply with *Chapter 9, Section 907.5.2.3.4*.

**11B-809.5.1.2 Activation.** All visible alarm appliances provided within the residential dwelling unit for building fire alarm notification shall be activated upon activation of the building fire alarm in the portion of the building containing the residential dwelling unit.

**11B-809.5.2 Residential dwelling unit smoke detection system.** Residential dwelling unit smoke detection systems shall comply with *Chapter 9, Section 907.2.11*.

**11B-809.5.2.1 Activation.** All visible alarm appliances provided within the residential dwelling unit for smoke detection notification shall be activated upon smoke detection.

**11B-809.5.3 Interconnection.** The same visible alarm appliances shall be permitted to provide notification of residential dwelling unit smoke detection and building fire alarm activation.

**11B-809.5.4 Prohibited use.** Visible alarm appliances used to indicate residential dwelling unit smoke detection or building fire alarm activation shall not be used for any other purpose within the residential dwelling unit.

**11B-809.5.5 Residential dwelling unit primary entrance.** Communication features shall be provided at the residential dwelling unit primary entrance complying with *Section 11B-809.5.5*.

**11B-809.5.5.1 Notification.** A hard-wired electric doorbell shall be provided. A button or switch shall be provided outside the residential dwelling unit primary entrance. Activation of the button or switch shall initiate an audible tone and visible signal within the residential dwelling unit. Where visible doorbell signals are located in sleeping areas, they shall have controls to deactivate the signal.

**11B-809.5.5.2 Identification.** A means for visually identifying a visitor without opening the residential dwelling unit entry door shall be provided and shall allow for a minimum 180 degree range of view.

**11B-809.5.6 Site, building, or floor entrance.** Where a system, including a closed-circuit system, permitting voice communication between a visitor and the occupant of the residential dwelling unit is provided, the system shall comply with *Section 11B-708.4*.

### 11B-810 Transportation facilities

**11B-810.1 General.** Transportation facilities shall comply with *Section 11B-810*.

**11B-810.1.1 Vehicle boarding.** Stations shall not be designed or constructed so as to require persons with disabilities to board or alight from a vehicle at a location other than one used by the general public.

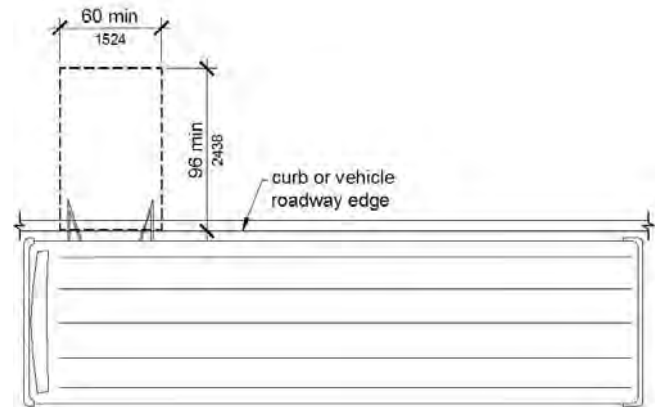
**11B-810.1.2 Baggage systems.** Baggage check-in and retrieval systems shall be on an accessible route complying with *Section 11B-402* and shall have space immediately adjacent complying with *Section 11B-302*.

**11B-810.2 Bus boarding and alighting areas.** Bus boarding and alighting areas shall comply with *Section 11B-810.2*.

**11B-810.2.1 Surface.** Bus stop boarding and alighting areas shall have a firm, stable surface.

**11B-810.2.2 Dimensions.** Bus stop boarding and alighting areas shall provide a clear length of 96 inches (2438 mm) minimum, measured perpendicular to the curb or vehicle

roadway edge, and a clear width of 60 inches (1524 mm) minimum, measured parallel to the vehicle roadway.

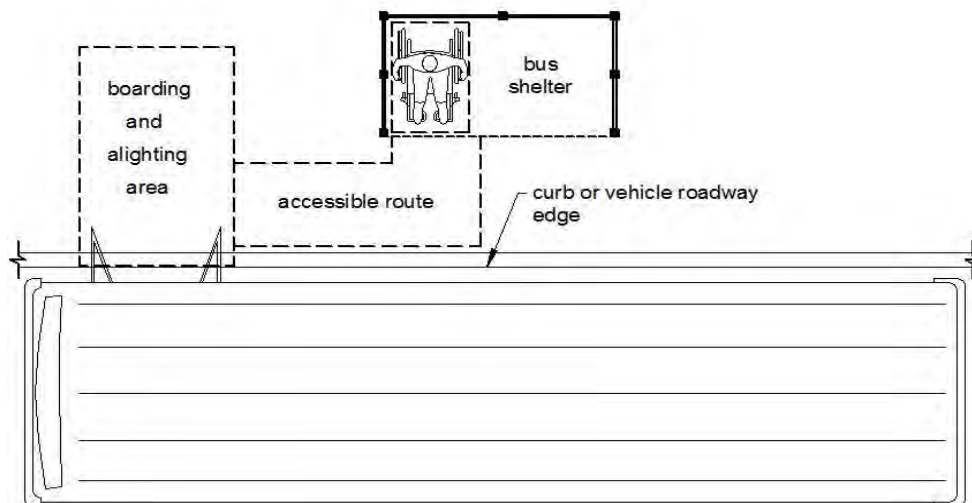


**FIGURE 11B-810.2.2**  
**DIMENSIONS OF BUS BOARDING AND ALIGHTING AREAS**

**11B-810.2.3 Connection.** Bus stop boarding and alighting areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route complying with *Section 11B-402*. Newly constructed bus stop pads shall provide a square curb transition between the pad and roadway elevations or detectable warnings complying with *Section 11B-705.2*.

**11B-810.2.4 Slope.** Parallel to the roadway, the slope of the bus stop boarding and alighting area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop boarding and alighting area shall not be steeper than 1:48.

**11B-810.3 Bus shelters.** Bus shelters shall provide a minimum clear floor or ground space complying with *Section 11B-305* entirely within the shelter. Bus shelters shall be connected by an accessible route complying with *Section 11B-402* to a boarding and alighting area complying with *Section 11B-810.2*.



**FIGURE 11B-810.3**  
**BUS SHELTERS**

**11B-810.4 Bus signs.** Bus route identification signs shall comply with *Sections 11B-703.5.1 through 11B-703.5.4*, and *Sections 11B-703.5.7 and 11B-703.5.8*. In addition, to the maximum extent practicable, bus route identification signs shall comply with *Section 11B-703.5.5*.

**Exception:** Bus schedules, timetables and maps that are posted at the bus stop or bus bay shall not be required to comply.

**11B-810.5 Rail platforms.** Rail platforms shall comply with *Section 11B-810.5*.

**11B-810.5.1 Slope.** Rail platforms shall not exceed a slope of 1:48 in all directions.

**Exception:** Where platforms serve vehicles operating on existing track or track laid in existing roadway, the slope of the platform parallel to the track shall be permitted to be equal to the slope (grade) of the roadway or existing track.

**11B-810.5.2 Detectable warnings.** Platform boarding edges not protected by platform screens or guards shall have detectable warnings complying with *Section 11B-705* along the full length of the public use area of the platform.

**11B-810.5.3 Platform and vehicle floor coordination.** Station platforms shall be positioned to coordinate with vehicles in accordance with the applicable requirements of 36 CFR Part 1192. Low-level platforms shall be 8 inches (203 mm) minimum above top of rail.

**Exception:** Where vehicles are boarded from sidewalks or street-level, low-level platforms shall be permitted to be less than 8 inches (203 mm).

**11B-810.6 Rail station signs.** Rail station signs shall comply with *Section 11B-810.6*.

**Exception:** Signs shall not be required to comply with *Sections 11B-810.6.1 and 11B-810.6.2* where audible signs are remotely transmitted to hand-held receivers, or are user- or proximity-actuated.

**11B-810.6.1 Entrances.** Where signs identify a station or its entrance, at least one sign at each entrance shall comply with *Section 11B-703.2* and shall be placed in uniform locations to the maximum extent practicable. Where signs identify a station that has no defined entrance, at least one sign shall comply with *Section 11B-703.2* and shall be placed in a central location.

**11B-810.6.2 Routes and destinations.** Lists of stations, routes and destinations served by the station which are located on boarding areas, platforms, or mezzanines shall comply with *Section 11B-703.5*. At least one tactile sign identifying the specific station and complying with *Section 11B-703.2* shall be provided on each platform or boarding area. Signs covered by this requirement shall, to the maximum extent practicable, be placed in uniform locations within the system.

**Exception:** Where sign space is limited, characters shall not be required to exceed 3 inches (76 mm).

**11B-810.6.3 Station names.** Stations covered by this section shall have identification signs complying with *Section 11B-703.5*. Signs shall be clearly visible and within the

sight lines of standing and sitting passengers from within the vehicle on both sides when not obstructed by another vehicle.

**11B-810.7 Public address systems.** Where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

**11B-810.8 Clocks.** Where clocks are provided for use by the public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals and digits shall contrast with the background either light-on-dark or dark-on-light. Where clocks are installed overhead, numerals and digits shall comply with *Section 11B-703.5*.

**11B-810.9 Escalators.** Where provided, escalators shall comply with *Sections 6.1.3.5.6 and 6.1.3.6.5* of ASME A17.1 and shall have a clear width of 32 inches (813 mm) minimum.

**Exception:** Existing escalators in key stations shall not be required to comply with *Section 11B-810.9*.

**11B-810.10 Track crossings.** Where a circulation path serving boarding platforms crosses tracks, it shall comply with *Section 11B-402*.

**Exception:** Openings for wheel flanges shall be permitted to be 2½ inches (64 mm) maximum.

#### 11B-811 Storage

**11B-811.1 General.** Storage shall comply with *Section 11B-*



FIGURE 11B-810.10 (EXCEPTION)  
TRACK CROSSINGS

811.

**11B-811.2 Clear floor or ground space.** A clear floor or ground space complying with *Section 11B-305* shall be provided.

**11B-811.3 Height.** Storage elements shall comply with at least one of the reach ranges specified in *Section 11B-308*.

**11B-811.4 Operable parts.** Operable parts shall comply with *Section 11B-309*.

## DIVISION 9: BUILT-IN ELEMENTS

### 11B-901 General

**11B-901.1 Scope.** The provisions of *Division 9* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-902 Dining surfaces and work surfaces

**11B-902.1 General.** Dining surfaces and work surfaces shall comply with *Sections 11B-902.2* and *11B-902.3*.

**Exception:** Dining surfaces and work surfaces for children's use shall be permitted to comply with *Section 11B-902.4*.

**11B-902.2 Clear floor or ground space.** A clear floor space complying with *Section 11B-305* positioned for a forward approach shall be provided. Knee and toe clearance complying with *Section 11B-306* shall be provided.

**11B-902.3 Height.** The tops of dining surfaces and work surfaces shall be 28 inches (711 mm) minimum and 34 inches (864 mm) maximum above the finish floor or ground.

**11B-902.4 Dining surfaces and work surfaces for children's use.** Accessible dining surfaces and work surfaces for children's use shall comply with *Section 11B-902.4*.

**Exception:** Dining surfaces and work surfaces that are used primarily by children 5 years and younger shall not be required to comply with *Section 11B-902.4* where a clear floor or ground space complying with *Section 11B-305* positioned for a parallel approach is provided.

**11B-902.4.1 Clear floor or ground space.** A clear floor space complying with *Section 11B-305* positioned for forward approach shall be provided. Knee and toe clearance complying with *Section 11B-306* shall be provided, except that knee clearance 24 inches (610 mm) minimum above the finish floor or ground shall be permitted.

**11B-902.4.2 Height.** The tops of tables and counters shall be 26 inches (660 mm) minimum and 30 inches (762 mm) maximum above the finish floor or ground.

### 11B-903 Benches

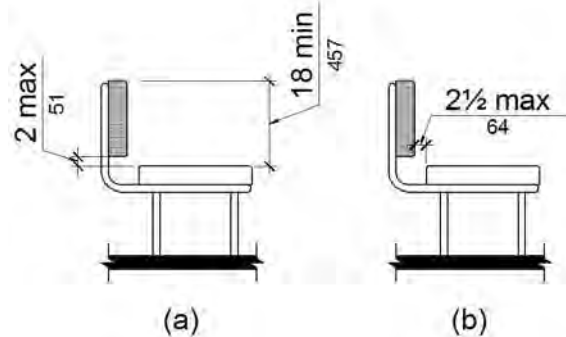
**11B-903.1 General.** Benches shall comply with *Section 11B-903*.

**11B-903.2 Clear floor or ground space.** Clear floor or ground space complying with *Section 11B-305* shall be provided and shall be positioned at the end of the bench seat and parallel to the short axis of the bench.

**11B-903.3 Size.** Benches shall have seats that are 48 inches (1219 mm) long minimum and 20 inches (508 mm) deep minimum and 24 inches (610 mm) deep maximum.

**11B-903.4 Back support.** The bench shall provide for back support or shall be affixed to a wall *along its long dimension*.

Back support shall be 48 inches (1219 mm) long minimum and shall extend from a point 2 inches (51 mm) maximum above the seat surface to a point 18 inches (457 mm) minimum above the seat surface. Back support shall be 2½ inches (64 mm) maximum from the rear edge of the seat measured horizontally.



**FIGURE 11B-903.4  
BENCH BACK SUPPORT**

**11B-903.5 Height.** The top of the bench seat surface shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the finish floor or ground.

**11B-903.6 Structural strength.** Benches shall be affixed to the wall or floor. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device, or supporting structure.

**11B-903.7 Wet locations.** Where installed in wet locations, the surface of the seat shall be slip resistant and shall not accumulate water.

### 11B-904 Check-out aisles and sales and service counters

**11B-904.1 General.** Check-out aisles and sales and service counters shall comply with the applicable requirements of *Section 11B-904*.

**11B-904.2 Approach.** All portions of counters required to comply with *Section 11B-904* shall be located adjacent to a walking surface complying with *Section 11B-403*.

**11B-904.3 Check-out aisles.** Check-out aisles shall comply with *Section 11B-904.3*.

**11B-904.3.1 Aisle.** Aisles shall comply with *Section 11B-403*.

**11B-904.3.2 Counter.** The counter surface height shall be 38 inches (965 mm) maximum above the finish floor or ground. The top of the counter edge protection shall be 2

inches (51 mm) maximum above the top of the counter surface on the aisle side of the check-out counter.

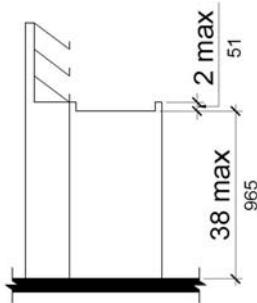


FIGURE 11B-904.3.2  
CHECK-OUT AISLE COUNTERS

**11B-904.3.3 Check writing surfaces.** Where provided, check writing surfaces shall comply with Section 11B-902.3.

**11B-904.3.4 Identification sign.** When not all check-out aisles are accessible, accessible check-out aisles shall be identified by a sign clearly visible to a person in a wheelchair displaying the International Symbol of Accessibility complying with Section 11B-703.7.2.1. The sign shall be a minimum of 4 inches by 4 inches (102 mm by 102 mm).

**11B-904.4 Sales and service counters.** Sales counters and service counters shall comply with Section 11B-904.4.1 or 11B-904.4.2. The accessible portion of the counter top shall extend the same depth as the sales or service counter top.

**Exception:** In alterations, when the provision of a counter complying with Section 11B-904.4 would result in a reduction of the number of existing counters at work stations or a reduction of the number of existing mail boxes, the counter shall be permitted to have a portion which is 24 inches (610 mm) long minimum complying with Section 11B-904.4.1 provided that the required clear floor or ground space is centered on the accessible length of the counter.

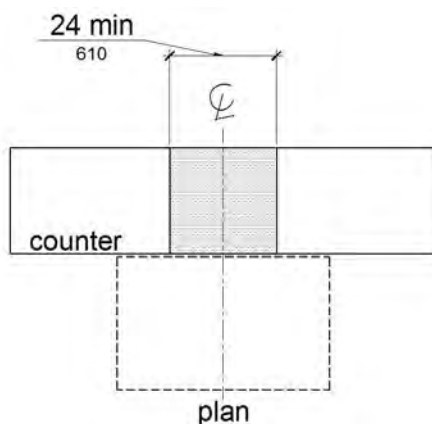


FIGURE 11B-904.4 (EXCEPTION)  
ALTERATION OF SALES AND SERVICE COUNTERS

**11B-904.4.1 Parallel approach.** A portion of the counter surface that is 36 inches (914 mm) long minimum and 34 inches (864 mm) high maximum above the finish floor shall be provided. A clear floor or ground space complying with Section 11B-305 shall be positioned for a parallel approach adjacent to the 36 inch (914 mm) minimum length of counter.

**Exception:** Where the provided counter surface is less than 36 inches (914 mm) long, the entire counter surface shall be 34 inches (864 mm) high maximum above the finish floor.

**11B-904.4.2 Forward approach.** A portion of the counter surface that is 36 inches (914 mm) long minimum and 34 inches (864 mm) high maximum shall be provided. Knee and toe space complying with Section 11B-306 shall be provided under the counter. A clear floor or ground space complying with Section 11B-305 shall be positioned for a forward approach to the counter.

**11B-904.5 Food service lines.** Counters in food service lines shall comply with Section 11B-904.5.

**11B-904.5.1 Self-service shelves and dispensing devices.** Self-service shelves and dispensing devices for tableware, dishware, condiments, food and beverages shall comply with Section 11B-308.

**11B-904.5.2 Tray slides.** The tops of tray slides shall be 28 inches (711 mm) minimum and 34 inches (864 mm) maximum above the finish floor or ground.

**11B-904.6 Security glazing.** Where counters or teller windows have security glazing to separate personnel from the public, a method to facilitate voice communication shall be provided. Telephone handset devices, if provided, shall comply with Section 11B-704.3.

## DIVISION 10: RECREATION FACILITIES

### 11B-1001 General

**11B-1001.1 Scope.** The provisions of *Division 10* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

### 11B-1002 Amusement rides

**11B-1002.1 General.** Amusement rides shall comply with *Section 11B-1002*.

**11B-1002.2 Accessible routes.** Accessible routes serving amusement rides shall comply with *Division 4*.

#### Exceptions:

1. In load or unload areas and on amusement rides, where compliance with *Section 11B-405.2* is not structurally or operationally feasible, ramp slope shall be permitted to be 1:8 maximum.
2. In load or unload areas and on amusement rides, handrails provided along walking surfaces complying with *Section 11B-403* and required on ramps complying with *Section 11B-405* shall not be required to comply with *Section 11B-505* where compliance is not structurally or operationally feasible.

**11B-1002.3 Load and unload areas.** A turning space complying with *Sections 11B-304.2* and *11B-304.3* shall be provided in load and unload areas.

**11B-1002.4 Wheelchair spaces in amusement rides.** Wheelchair spaces in amusement rides shall comply with *Section 11B-1002.4*.

**11B-1002.4.1 Floor or ground surface.** The floor or ground surface of wheelchair spaces shall be stable and firm.

**11B-1002.4.2 Slope.** The floor or ground surface of wheelchair spaces shall have a slope not steeper than 1:48 when in the load and unload position.

**11B-1002.4.3 Gaps.** Floors of amusement rides with wheelchair spaces and floors of load and unload areas shall be coordinated so that, when amusement rides are at rest in the load and unload position, the vertical difference between the floors shall be within plus or minus  $\frac{5}{8}$  inches (15.9 mm) and the horizontal gap shall be 3 inches (76 mm) maximum under normal passenger load conditions.

**Exception:** Where compliance is not operationally or structurally feasible, ramps, bridge plates, or similar devices complying with the applicable requirements of 36 CFR 1192.83(c) shall be provided.

**11B-1002.4.4 Clearances.** Clearances for wheelchair spaces shall comply with *Section 11B-1002.4.4*.

#### Exceptions:

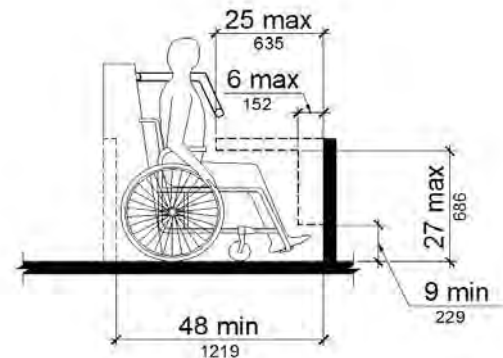
1. Where provided, securement devices shall be permitted to overlap required clearances.

2. Wheelchair spaces shall be permitted to be mechanically or manually repositioned.
3. Wheelchair spaces shall not be required to comply with *Section 11B-307.4*.

**11B-1002.4.4.1 Width and length.** Wheelchair spaces shall provide a clear width of 30 inches (762 mm) minimum and a clear length of 48 inches (1219 mm) minimum measured to 9 inches (229 mm) minimum above the floor surface.

**11B-1002.4.4.2 Side entry.** Where wheelchair spaces are entered only from the side, amusement rides shall be designed to permit sufficient maneuvering clearance for individuals using a wheelchair or mobility aid to enter and exit the ride.

**11B-1002.4.4.3 Permitted protrusions in wheelchair spaces.** Objects are permitted to protrude a distance of 6 inches (152 mm) maximum along the front of the wheelchair space, where located 9 inches (229 mm) minimum and 27 inches (686 mm) maximum above the floor or ground surface of the wheelchair space. Objects are permitted to protrude a distance of 25 inches (635 mm) maximum along the front of the wheelchair space, where located more than 27 inches (686 mm) above the floor or ground surface of the wheelchair space.



**FIGURE 11B-1002.4.4.3  
PROTRUSIONS IN WHEELCHAIR  
SPACES IN AMUSEMENT RIDES**

**11B-1002.4.5 Ride entry.** Openings providing entry to wheelchair spaces on amusement rides shall be 32 inches (813 mm) minimum clear.

**11B-1002.4.6 Approach.** One side of the wheelchair space shall adjoin an accessible route when in the load and unload position.

**11B-1002.4.7 Companion seats.** Where the interior width of the amusement ride is greater than 53 inches (1346 mm), seating is provided for more than one rider, and the wheelchair is not required to be centered within the



amusement ride, a companion seat shall be provided for each wheelchair space.

**11B-1002.4.7.1 Shoulder-to-shoulder seating.** Where an amusement ride provides shoulder-to-shoulder seating, companion seats shall be shoulder-to-shoulder with the adjacent wheelchair space.

**Exception:** Where shoulder-to-shoulder companion seating is not operationally or structurally feasible, compliance with this requirement shall be required to the maximum extent practicable.

**11B-1002.5 Amusement ride seats designed for transfer.** Amusement ride seats designed for transfer shall comply with *Section 11B-1002.5* when positioned for loading and unloading.

**11B-1002.5.1 Clear floor or ground space.** A clear floor or ground space complying with *Section 11B-305* shall be provided in the load and unload area adjacent to the amusement ride seats designed for transfer.

**11B-1002.5.2 Transfer height.** The height of amusement ride seats designed for transfer shall be 14 inches (356 mm) minimum and 24 inches (610 mm) maximum measured from the surface of the load and unload area.

**11B-1002.5.3 Transfer entry.** Where openings are provided for transfer to amusement ride seats, the openings shall provide clearance for transfer from a wheelchair or mobility aid to the amusement ride seat.

**11B-1002.5.4 Wheelchair storage space.** Wheelchair storage spaces complying with *Section 11B-305* shall be provided in or adjacent to unload areas for each required amusement ride seat designed for transfer and shall not overlap any required means of egress or accessible route.

**11B-1002.6 Transfer devices for use with amusement rides.** Transfer devices for use with amusement rides shall comply with *Section 11B-1002.6* when positioned for loading and unloading.

**11B-1002.6.1 Clear floor or ground space.** A clear floor or ground space complying with *Section 11B-305* shall be provided in the load and unload area adjacent to the transfer device.

**11B-1002.6.2 Transfer height.** The height of transfer device seats shall be 14 inches (356 mm) minimum and 24 inches (610 mm) maximum measured from the load and unload surface.

**11B-1002.6.3 Wheelchair storage space.** Wheelchair storage spaces complying with *Section 11B-305* shall be provided in or adjacent to unload areas for each required transfer device and shall not overlap any required means of egress or accessible route.

### **11B-1003 Recreational boating facilities**

**11B-1003.1 General.** Recreational boating facilities shall comply with *Section 11B-1003*.

**11B-1003.2 Accessible routes.** Accessible routes serving recreational boating facilities, including gangways and floating piers, shall comply with *Division 4* except as modified by the exceptions in *Section 11B-1003.2*.

**11B-1003.2.1 Boat slips.** Accessible routes serving boat slips shall be permitted to use the exceptions in *Section 11B-1003.2.1*.

#### **Exceptions:**

1. Where an existing gangway or series of gangways is replaced or altered, an increase in the length of the gangway shall not be required to comply with *Section 11B-1003.2* unless required by *Section 11B-202.4*.
2. Gangways shall not be required to comply with the maximum rise specified in *Section 11B-405.6*.
3. Where the total length of a gangway or series of gangways serving as part of a required accessible route is 80 feet (24384 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.
4. Where facilities contain fewer than 25 boat slips and the total length of the gangway or series of gangways serving as part of a required accessible route is 30 feet (9144 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.
5. Where gangways connect to transition plates, landings specified by *Section 11B-405.7* shall not be required.
6. Where gangways and transition plates connect and are required to have handrails, handrail extensions shall not be required. Where handrail extensions are provided on gangways or transition plates, the handrail extensions shall not be required to be parallel with the ground or floor surface.
7. The cross slope specified in *Sections 11B-403.3* and *11B-405.3* for gangways, transition plates, and floating piers that are part of accessible routes shall be measured in the static position.
8. Changes in level complying with *Sections 11B-303.3* and *11B-303.4* shall be permitted on the surfaces of gangways and boat launch ramps.

**11B-1003.2.2 Boarding piers at boat launch ramps.** Accessible routes serving boarding piers at boat launch ramps shall be permitted to use the exceptions in *Section 11B-1003.2.2*.

#### **Exceptions:**

1. Accessible routes serving floating boarding piers shall be permitted to use Exceptions 1, 2, 5, 6, 7 and 8 in *Section 11B-1003.2.1*.
2. Where the total length of the gangway or series of gangways serving as part of a required accessible route is 30 feet (9144 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.
3. Where the accessible route serving a floating boarding pier or skid pier is located within a boat launch ramp, the portion of the accessible route



located within the boat launch ramp shall not be required to comply with *Section 11B-405*.

**11B-1003.3 Clearances.** Clearances at boat slips and on boarding piers at boat launch ramps shall comply with *Section 11B-1003.3*.

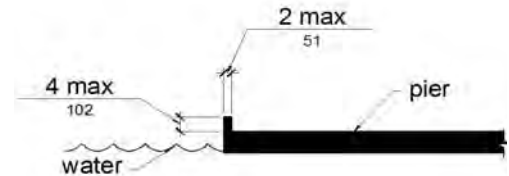
**11B-1003.3.1 Boat slip clearance.** Boat slips shall provide clear pier space 60 inches (1524 mm) wide minimum and at least as long as the boat slips. Each 10 feet (3048 mm) maximum of linear pier edge serving boat slips shall contain at least one continuous clear opening 60 inches (1524 mm) wide minimum.

**Exceptions:**

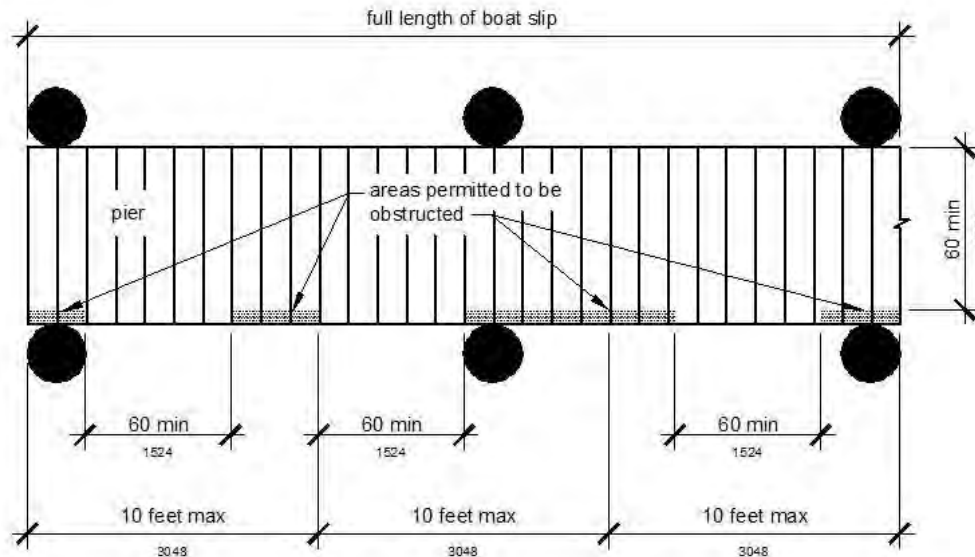
1. Clear pier space shall be permitted to be 36 inches (914 mm) wide minimum for a length of 24 inches (610 mm) maximum, provided that multiple 36 inch (914 mm) wide segments are separated by segments that are 60 inches (1524 mm) wide minimum.

mm) wide minimum and 60 inches (1524 mm) long minimum.

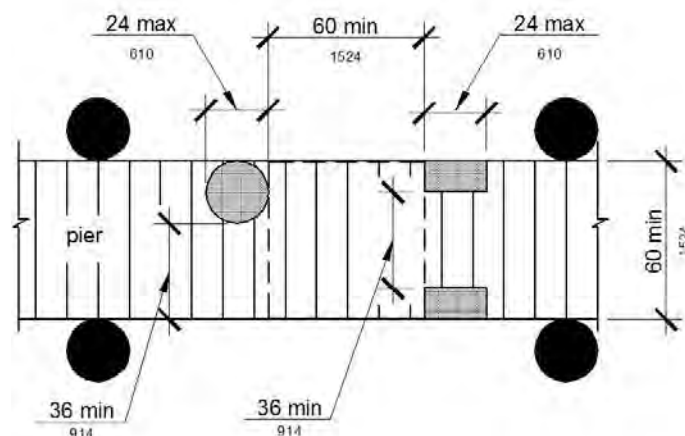
2. Edge protection shall be permitted at the continuous clear openings, provided that it is 4 inches (102 mm) high maximum and 2 inches (51 mm) wide maximum.
3. In existing piers, clear pier space shall be permitted to be located perpendicular to the boat slip and shall extend the width of the boat slip, where



**FIGURE 11B-1003.3.1 (EXCEPTION 2)  
EDGE PROTECTION AT BOAT SLIPS**



**FIGURE 11B-1003.3.1  
BOAT SLIP CLEARANCE**



**FIGURE 11B-1003.3.1 (EXCEPTION 1)  
CLEAR PIER SPACE REDUCTION AT BOAT SLIPS**

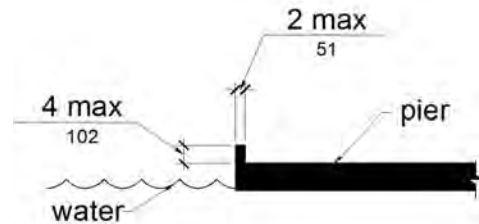
the facility has at least one boat slip complying with *Section 11B-1003.3*, and further compliance with *Section 11B-1003.3* would result in a reduction in the number of boat slips available or result in a reduction of the widths of existing slips.

**11B-1003.3.2 Boarding pier clearances.** Boarding piers at boat launch ramps shall provide clear pier space 60 inches (1524 mm) wide minimum and shall extend the full length of the boarding pier. Every 10 feet (3048 mm) maximum of linear pier edge shall contain at least one continuous clear opening 60 inches (1524 mm) wide minimum.

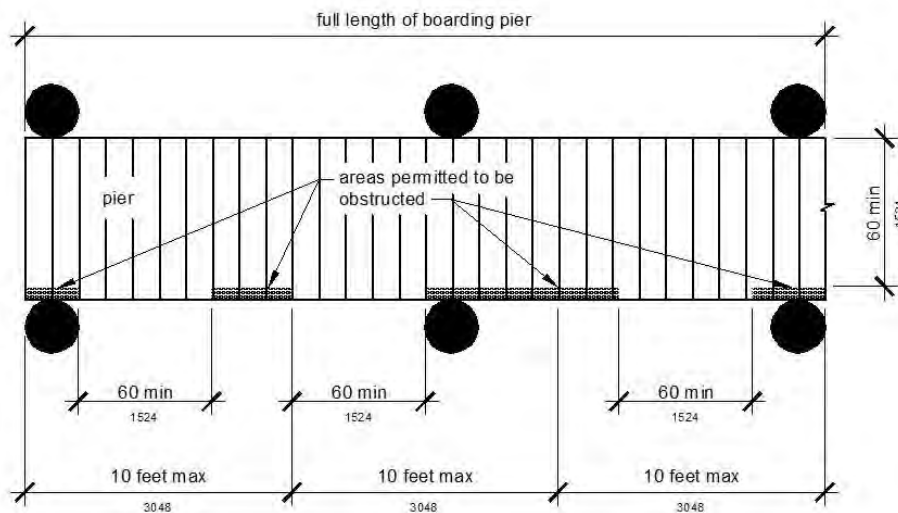
**Exceptions:**

1. The clear pier space shall be permitted to be 36 inches (914 mm) wide minimum for a length of 24 inches (610 mm) maximum provided that multiple 36 inch (914 mm) wide segments are separated by segments that are 60 inches (1524 mm) wide minimum and 60 inches (1524 mm) long minimum.

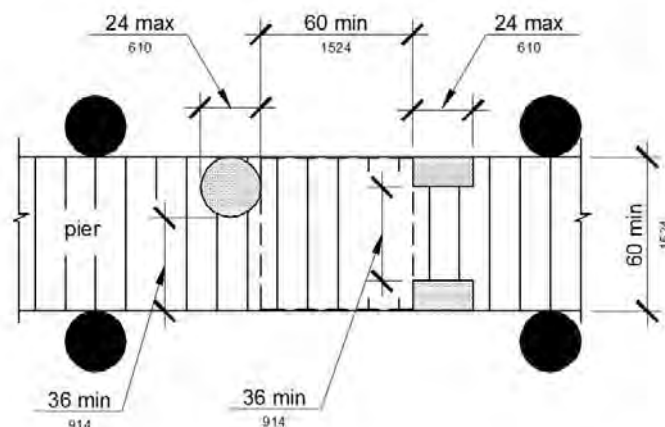
2. Edge protection shall be permitted at the continuous clear openings provided that it is 4 inches (102 mm) high maximum and 2 inches (51 mm) wide maximum.



**FIGURE 11B-1003.3.2 (EXCEPTION 2)  
EDGE PROTECTION AT BOARDING PIERS**



**FIGURE 11B-1003.3.2  
BOARDING PIER CLEARANCE**



**FIGURE 11B-1003.3.2 (EXCEPTION 1)  
CLEAR PIER SPACE REDUCTION AT BOARDING PIERS**

**11B-1004 Exercise machines and equipment**

**11B-1004.1 Clear floor space.** Exercise machines and equipment shall have a clear floor space complying with *Section 11B-305* positioned for transfer or for use by an individual seated in a wheelchair. Clear floor or ground spaces required at exercise machines and equipment shall be permitted to overlap.

**11B-1005 Fishing piers and platforms**

**11B-1005.1 Accessible routes.** Accessible routes serving fishing piers and platforms, including gangways and floating piers, shall comply with *Division 4*.

**Exceptions:**

1. Accessible routes serving floating fishing piers and platforms shall be permitted to use Exceptions 1, 2, 5, 6, 7 and 8 in *Section 11B-1003.2.1*.
2. Where the total length of the gangway or series of gangways serving as part of a required accessible route is 30 feet (9144 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.

**11B-1005.2 Railings.** Where provided, railings, guards, or handrails shall comply with *Section 11B-1005.2*.

**11B-1005.2.1 Height.** At least 25 percent of the railings, guards, or handrails shall be 34 inches (864 mm) maximum above the ground or deck surface.

**Exception:** Where a guard complying with *Chapter 10, Sections 1013.2 through 1013.4* is provided, the guard shall not be required to comply with *Section 11B-1005.2.1*.

**11B-1005.2.1.1 Dispersion.** Railings, guards, or handrails required to comply with *Section 11B-1005.2.1* shall be dispersed throughout the fishing pier or platform.

**11B-1005.3 Edge protection.** Where railings, guards, or handrails complying with *Section 11B-1005.2* are provided, edge protection complying with *Section 11B-1005.3.1* or *11B-1005.3.2* shall be provided.

**11B-1005.3.1 Curb or barrier.** Curbs or barriers shall extend 2 inches (51 mm) minimum above the surface of the fishing pier or platform.

**11B-1005.3.2 Extended ground or deck surface.** The ground or deck surface shall extend 12 inches (305 mm) minimum beyond the inside face of the railing. Toe clearance shall be provided and shall be 30 inches (762 mm) wide minimum and 9 inches (229 mm) minimum above the ground or deck surface beyond the railing.

**11B-1005.4 Clear floor or ground space.** At each location where there are railings, guards, or handrails complying with *Section 11B-1005.2.1*, a clear floor or ground space complying with *Section 11B-305* shall be provided. Where there are no railings, guards, or handrails, at least one clear floor or ground space complying with *Section 11B-305* shall be provided on the fishing pier or platform.

**11B-1005.5 Turning space.** At least one turning space complying with *Section 11B-304.3* shall be provided on fishing piers and platforms.

**11B-1006 Golf facilities**

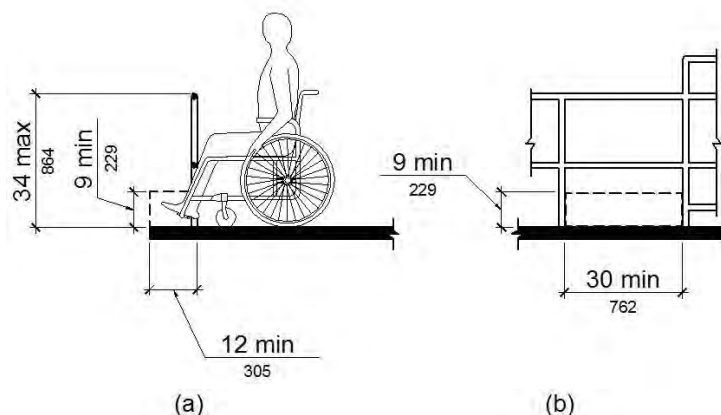
**11B-1006.1 General.** Golf facilities shall comply with *Section 11B-1006*.

**11B-1006.2 Accessible routes.** Accessible routes serving teeing grounds, practice teeing grounds, putting greens, practice putting greens, teeing stations at driving ranges, course weather shelters, golf car rental areas, bag drop areas, and course toilet rooms shall comply with *Division 4* and shall be 48 inches (1219 mm) wide minimum. Where handrails are provided, accessible routes shall be 60 inches (1524 mm) wide minimum.

**Exception:** Handrails shall not be required on golf courses. Where handrails are provided on golf courses, the handrails shall not be required to comply with *Section 11B-505*.

**11B-1006.3 Golf car passages.** Golf car passages shall comply with *Section 11B-1006.3*.

**11B-1006.3.1 Clear width.** The clear width of golf car passages shall be 48 inches (1219 mm) minimum.



**FIGURE 11B-1005.3.2**  
**EXTENDED GROUND OR DECK SURFACE AT FISHING PIERS AND PLATFORMS**

**11B-1006.3.2 Barriers.** Where curbs or other constructed barriers prevent golf cars from entering a fairway, openings 60 inches (1524 mm) wide minimum shall be provided at intervals not to exceed 75 yards (69 m).

**11B-1006.4 Weather shelters.** A clear floor or ground space 60 inches (1524 mm) minimum by 96 inches (2438 mm) minimum shall be provided within weather shelters.

#### **11B-1007 Miniature golf facilities**

**11B-1007.1 General.** Miniature golf facilities shall comply with *Section 11B-1007*.

**11B-1007.2 Accessible routes.** Accessible routes serving holes on miniature golf courses shall comply with *Division 4*. Accessible routes located on playing surfaces of miniature golf holes shall be permitted to use the exceptions in *Section 11B-1007.2*.

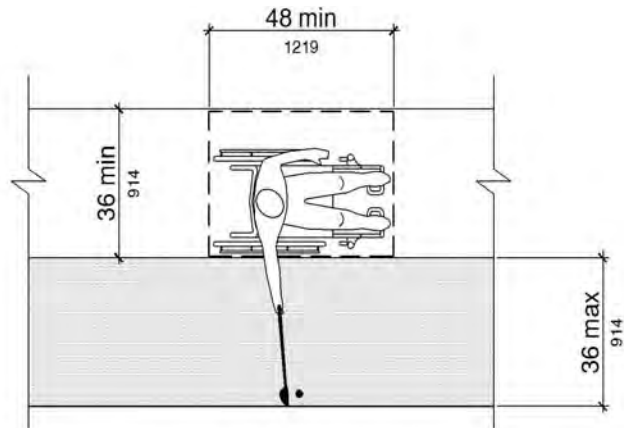
##### **Exceptions:**

1. Playing surfaces shall not be required to comply with *Section 11B-302.2*.
2. Where accessible routes intersect playing surfaces of holes, a 1 inch (25 mm) maximum curb shall be permitted for a width of 32 inches (813 mm) minimum.
3. A slope not steeper than 1:4 for a 4 inch (102 mm) maximum rise shall be permitted.
4. Ramp landing slopes specified by *Section 11B-405.7.1* shall be permitted to be 1:20 maximum.
5. Ramp landing length specified by *Section 11B-405.7.3* shall be permitted to be 48 inches (1219 mm) long minimum.
6. Ramp landing size specified by *Section 11B-405.7.4* shall be permitted to be 48 inches (1219 mm) minimum by 60 inches (1524 mm) minimum.
7. Handrails shall not be required on holes. Where handrails are provided on holes, the handrails shall not be required to comply with *Section 11B-505*.

**11B-1007.3 Miniature golf holes.** Miniature golf holes shall comply with *Section 11B-1007.3*.

**11B-1007.3.1 Start of play.** A clear floor or ground space 48 inches (1219 mm) minimum by 60 inches (1524 mm) minimum with slopes not steeper than 1:48 shall be provided at the start of play.

**11B-1007.3.2 Golf club reach range area.** All areas within holes where golf balls rest shall be within 36 inches (914 mm) maximum of a clear floor or ground space 36 inches (914 mm) wide minimum and 48 inches (1219 mm) long minimum having a running slope not steeper than 1:20. The clear floor or ground space shall be served by an accessible route.



Note: Running Slope of Clear Floor or Ground Space Not Steeper Than 1:20

**FIGURE 11B-1007.3.2  
GOLF CLUB REACH RANGE AREA**

#### **11B-1008 Play areas**

**11B-1008.1 General.** Play areas shall comply with *Section 11B-1008*.

**11B-1008.2 Accessible routes.** Accessible routes serving play areas shall comply with *Division 4* and *Section 11B-1008.2* and shall be permitted to use the exceptions in *Sections 11B-1008.2.1* through *11B-1008.2.3*. Where accessible routes serve ground level play components, the vertical clearance shall be 80 inches high (2032 mm) minimum.

**11B-1008.2.1 Ground level and elevated play components.** Accessible routes serving ground level play components and elevated play components shall be permitted to use the exceptions in *Section 11B-1008.2.1*.

##### **Exceptions:**

1. Transfer systems complying with *Section 11B-1008.3* shall be permitted to connect elevated play components except where 20 or more elevated play components are provided no more than 25 percent of the elevated play components shall be permitted to be connected by transfer systems.
2. Where transfer systems are provided, an elevated play component shall be permitted to connect to another elevated play component as part of an accessible route.

**11B-1008.2.2 Soft contained play structures.** Accessible routes serving soft contained play structures shall be permitted to use the exception in *Section 11B-1008.2.2*.

**Exception:** Transfer systems complying with *Section 11B-1008.3* shall be permitted to be used as part of an accessible route.

**11B-1008.2.3 Water play components.** Accessible routes serving water play components shall be permitted to use the exceptions in *Section 11B-1008.2.3*.

**Exceptions:**

1. Where the surface of the accessible route, clear floor or ground spaces, or turning spaces serving water play components is submerged, compliance with *Sections 11B-302, 11B-403.3, 11B-405.2, 11B-405.3, and 11B-1008.2.6* shall not be required.
2. Transfer systems complying with *Section 11B-1008.3* shall be permitted to connect elevated play components in water.

**11B-1008.2.4 Clear width.** Accessible routes connecting play components shall provide a clear width complying with *Section 11B-1008.2.4*.

**11B-1008.2.4.1 Ground level.** At ground level, the clear width of accessible routes shall be 60 inches (1524 mm) minimum.

**Exceptions:**

1. In play areas less than 1000 square feet (93 m<sup>2</sup>), the clear width of accessible routes shall be permitted to be 44 inches (1118 mm) minimum, if at least one turning space complying with *Section 11B-304.3* is provided where the restricted accessible route exceeds 30 feet (9144 mm) in length.
2. The clear width of accessible routes shall be permitted to be 36 inches (914 mm) minimum for a distance of 60 inches (1524 mm) maximum provided that multiple reduced width segments are separated by segments that are 60 inches (1524 mm) wide minimum and 60 inches (1524 mm) long minimum.

**11B-1008.2.4.2 Elevated.** The clear width of accessible routes connecting elevated play components shall be 36 inches (914 mm) minimum.

**Exceptions:**

1. The clear width of accessible routes connecting elevated play components shall be permitted to be reduced to 32 inches (813 mm) minimum for a distance of 24 inches (610 mm) maximum provided that reduced width segments are separated by segments that are 48 inches (1219 mm) long minimum and 36 inches (914 mm) wide minimum.
2. The clear width of transfer systems connecting elevated play components shall be permitted to be 24 inches (610 mm) minimum.

**11B-1008.2.5 Ramps.** Within play areas, ramps connecting ground level play components and ramps connecting elevated play components shall comply with *Section 11B-1008.2.5*.

**11B-1008.2.5.1 Ground level.** Ramp runs connecting ground level play components shall have a running slope not steeper than 1:16.

**11B-1008.2.5.2 Elevated.** The rise for any ramp run connecting elevated play components shall be 12 inches (305 mm) maximum.

**11B-1008.2.5.3 Handrails.** Where required on ramps serving play components, the handrails shall comply with *Section 11B-505* except as modified by *Section 11B-1008.2.5.3*.

**Exceptions:**

1. Handrails shall not be required on ramps located within ground level use zones.
2. Handrail extensions shall not be required.

**11B-1008.2.5.3.1 Handrail gripping surfaces.** Handrail gripping surfaces with a circular cross section shall have an outside diameter of 0.95 inch (24 mm) minimum and 1.55 inches (39 mm) maximum. Where the shape of the gripping surface is non-circular, the handrail shall provide an equivalent gripping surface.

**11B-1008.2.5.3.2 Handrail height.** The top of handrail gripping surfaces shall be 20 inches (508 mm) minimum and 28 inches (711 mm) maximum above the ramp surface.

**11B-1008.2.6 Ground surfaces.** Ground surfaces on accessible routes, clear floor or ground spaces, and turning spaces shall comply with *Section 11B-1008.2.6*.

**11B-1008.2.6.1 Accessibility.** Ground surfaces shall comply with ASTM F 1951. Ground surfaces shall be inspected and maintained regularly and frequently to ensure continued compliance with ASTM F 1951.

**11B-1008.2.6.2 Use zones.** Ground surfaces located within use zones shall comply with ASTM F 1292.

**11B-1008.3 Transfer systems.** Where transfer systems are provided to connect to elevated play components, transfer systems shall comply with *Section 11B-1008.3*.

**11B-1008.3.1 Transfer platforms.** Transfer platforms shall be provided where transfer is intended from wheelchairs or other mobility aids. Transfer platforms shall comply with *Section 11B-1008.3.1*.

**11B-1008.3.1.1 Size.** Transfer platforms shall have level surfaces 14 inches (356 mm) deep minimum and 24 inches (610 mm) wide minimum.

**11B-1008.3.1.2 Height.** The height of transfer platforms shall be 11 inches (279 mm) minimum and 18 inches (457 mm) maximum measured to the top of the surface from the ground or floor surface.

**11B-1008.3.1.3 Transfer space.** A transfer space complying with *Sections 11B-305.2 and 11B-305.3* shall be provided adjacent to the transfer platform. The 48 inch (1219 mm) long minimum dimension of the transfer space shall be centered on and parallel to the 24 inch (610 mm) long minimum side of the transfer platform. The side of the transfer platform serving the transfer space shall be unobstructed.

**11B-1008.3.1.4 Transfer supports.** At least one means of support for transferring shall be provided.

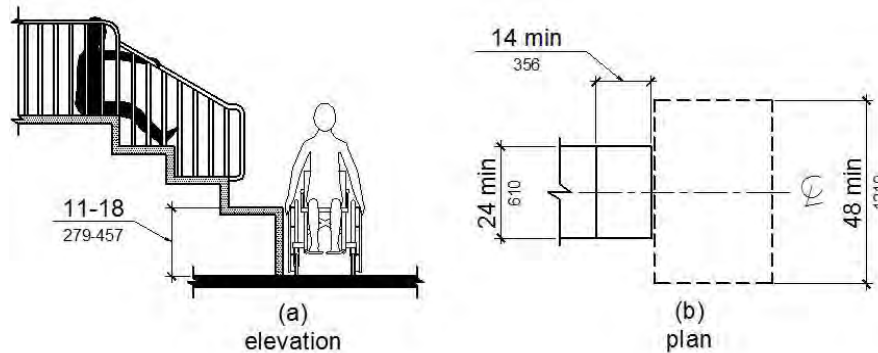


FIGURE 11B-1008.3.1  
TRANSFER PLATFORMS

**11B-1008.3.2 Transfer steps.** Transfer steps shall be provided where movement is intended from transfer platforms to levels with elevated play components required to be on accessible routes. Transfer steps shall comply with *Section 11B-1008.3.2*.

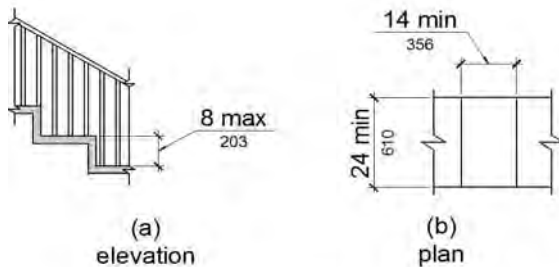


FIGURE 11B-1008.3.2  
TRANSFER STEPS

**11B-1008.3.2.1 Size.** Transfer steps shall have level surfaces 14 inches (356 mm) deep minimum and 24 inches (610 mm) wide minimum.

**11B-1008.3.2.2 Height.** Each transfer step shall be 8 inches (203 mm) high maximum.

**11B-1008.3.2.3 Transfer supports.** At least one means of support for transferring shall be provided.

**11B-1008.3.2.4 Contrasting stripe.** Striping complying with *Section 11B-504.4.1* shall be provided at each transfer step.

**11B-1008.4 Play components.** Ground level play components on accessible routes and elevated play components connected by ramps shall comply with *Section 11B-1008.4*.

**11B-1008.4.1 Turning space.** At least one turning space complying with *Section 11B-304* shall be provided on the same level as play components. Where swings are provided, the turning space shall be located immediately adjacent to the swing.

**11B-1008.4.2 Clear floor or ground space.** Clear floor or ground space complying with *Sections 11B-305.2* and *11B-305.3* shall be provided at play components.

**11B-1008.4.3 Play tables.** Where play tables are provided, knee clearance 24 inches (610 mm) high minimum, 17 inches deep (432 mm) minimum, and 30 inches (762 mm) wide minimum shall be provided. The tops of rims,

curbs, or other obstructions shall be 31 inches (787 mm) high maximum.

**Exception:** Play tables designed and constructed primarily for children 5 years and younger shall not be required to provide knee clearance where the clear floor or ground space required by *Section 11B-1008.4.2* is arranged for a parallel approach.

**11B-1008.4.4 Entry points and seats.** Where play components require transfer to entry points or seats, the entry points or seats shall be 11 inches (279 mm) minimum and 24 inches (610 mm) maximum from the clear floor or ground space.

**Exception:** Entry points of slides shall not be required to comply with *Section 11B-1008.4.4*.

**11B-1008.4.5 Transfer supports.** Where play components require transfer to entry points or seats, at least one means of support for transferring shall be provided.

#### 11B-1009 Swimming pools, wading pools, and spas

**11B-1009.1 General.** Where provided, pool lifts, sloped entries, transfer walls, transfer systems, and pool stairs shall comply with *Section 11B-1009*.

**11B-1009.2 Pool lifts.** Pool lifts shall comply with *Section 11B-1009.2*.

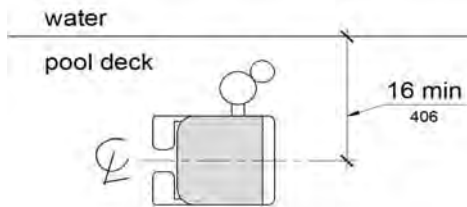
**11B-1009.2.1 Pool lift location.** Pool lifts shall be located where the water level is 36 inches (914 mm) minimum and 48 inches (1219 mm) maximum.

##### Exceptions:

1. Where the entire pool depth is greater than 48 inches (1219 mm), compliance with *Section 11B-1009.2.1* shall not be required.
2. Where multiple pool lift locations are provided, no more than one pool lift shall be required to be located in an area where the water level is 48 inches (1219 mm) maximum.
3. Where the water depth of the entire swimming pool, wading pool or spa is less than 36 inches (914 mm), pool lifts shall be located where the water level is less than 36 inches (914 mm).

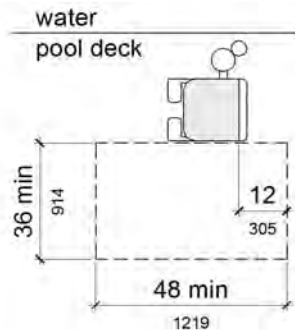
**11B-1009.2.2 Seat location.** In the raised position, the centerline of the seat shall be located over the deck and 16 inches (406 mm) minimum from the edge of the pool. The

deck surface between the centerline of the seat and the pool edge shall have a slope not steeper than 1:48.



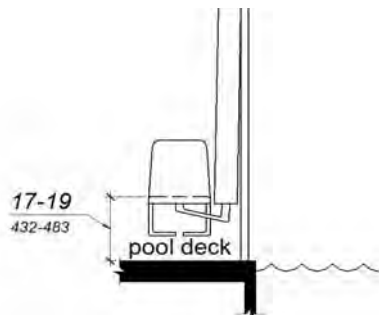
**FIGURE 11B-1009.2.2  
POOL LIFT SEAT LOCATION**

**11B-1009.2.3 Clear deck space.** On the side of the seat opposite the water, a clear deck space shall be provided parallel with the seat. The space shall be 36 inches (914 mm) wide minimum and shall extend forward 48 inches (1219 mm) minimum from a line located 12 inches (305 mm) behind the rear edge of the seat. The clear deck space shall have a slope not steeper than 1:48.



**FIGURE 11B-1009.2.3  
CLEAR DECK SPACE AT POOL LIFTS**

**11B-1009.2.4 Seat.** The seat shall be rigid and shall have a back support that is at least 12 inches (305 mm) tall. The height of the lift seat shall be designed to allow a stop at 17 inches (423 mm) minimum to 19 inches (483 mm) maximum measured from the deck to the top of the seat surface when in the raised (load) position. The seat shall have a restraint for the use of the occupant with operable parts complying with Section 11B-309.



**FIGURE 11B-1009.2.4  
POOL LIFT SEAT HEIGHT**

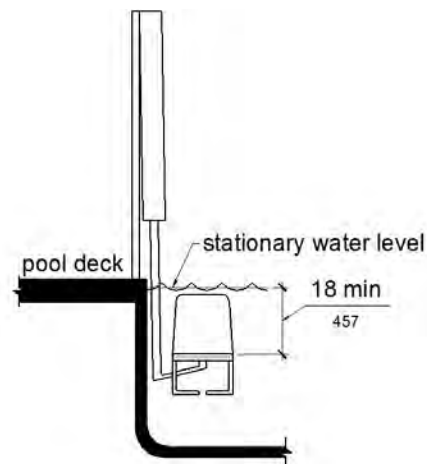
**11B-1009.2.5 Seat width.** The seat shall be 16 inches (406 mm) wide minimum.

**11B-1009.2.6 Footrests and armrests.** Footrests shall be provided and shall move with the seat. The seat shall have two armrests. The armrest positioned opposite the water shall be removable or shall fold clear of the seat when the seat is in the raised (load) position.

**Exception:** Footrests shall not be required on pool lifts provided in spas.

**11B-1009.2.7 Operation.** The lift shall be capable of unassisted operation from both the deck and water levels. Controls and operating mechanisms shall be unobstructed when the lift is in use and shall comply with Section 11B-309.4. The lift shall be stable and not permit unintended movement when a person is getting into or out of the seat.

**11B-1009.2.8 Submerged depth.** The lift shall be designed so that the seat will submerge to a water depth of 18 inches (457 mm) minimum below the stationary water level.



**FIGURE 11B-1009.2.8  
POOL LIFT SUBMERGED DEPTH**

**11B-1009.2.9 Lifting capacity.** Single person pool lifts shall have a weight capacity of 300 pounds (136 kg) minimum and be capable of sustaining a static load of at least one and a half times the rated load.

**11B-1009.3 Sloped entries.** Sloped entries shall comply with Section 11B-1009.3.

**11B-1009.3.1 Sloped entries.** Sloped entries shall comply with Division 4 except as modified in Sections 11B-1009.3.1 through 11B-1009.3.3.

**Exception:** Where sloped entries are provided, the surfaces shall not be required to be slip resistant.

**11B-1009.3.2 Submerged depth.** Sloped entries shall extend to a depth of 24 inches (610 mm) minimum and 30 inches (762 mm) maximum below the stationary water level. Where landings are required by Section 11B-405.7, at least one landing shall be located 24 inches (610 mm) minimum and 30 inches (762 mm) maximum below the stationary water level.

**Exception:** In wading pools, the sloped entry and landings, if provided, shall extend to the deepest part of the wading pool.



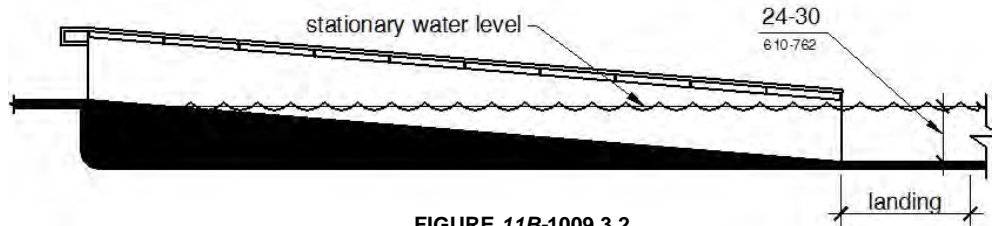


FIGURE 11B-1009.3.2  
SLOPED ENTRY SUBMERGED DEPTH

**11B-1009.3.3 Handrails.** At least two handrails complying with Section 11B-505 shall be provided on the sloped entry. The clear width between required handrails shall be 33 inches (838 mm) minimum and 38 inches (965 mm) maximum.

**Exceptions:**

1. Handrail extensions specified by Section 11B-505.10.1 shall not be required at the bottom landing serving a sloped entry.
2. Where a sloped entry is provided for wave action pools, leisure rivers, sand bottom pools, and other pools where user access is limited to one area, the handrails shall not be required to comply with the clear width requirements of Section 11B-1009.3.3.
3. Sloped entries in wading pools shall not be required to provide handrails complying with Section 11B-1009.3.3. If provided, handrails on

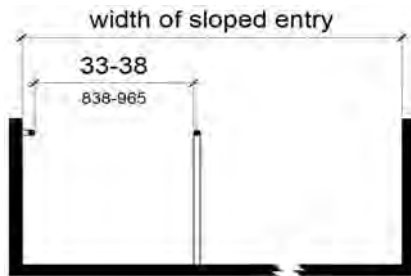


FIGURE 11B-1009.3.3  
HANDRAILS FOR SLOPED ENTRY

sloped entries in wading pools shall not be required to comply with Section 11B-505.

**11B-1009.4 Transfer walls.** Transfer walls shall comply with Section 11B-1009.4.

**11B-1009.4.1 Clear deck space.** A clear deck space of 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum with a slope not steeper than 1:48 shall be provided at the base of the transfer wall. Where one grab bar is provided, the clear deck space shall be centered on the grab bar. Where two grab bars are provided, the clear deck space shall be centered on the clearance between the grab bars.

**11B-1009.4.2 Height.** The height of the transfer wall shall be 16 inches (406 mm) minimum and 19 inches (483 mm) maximum measured from the deck.

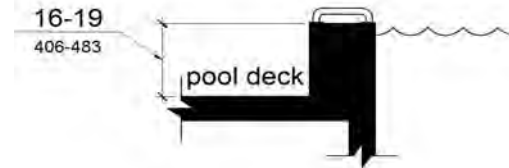


FIGURE 11B-1009.4.2  
TRANSFER WALL HEIGHT

**11B-1009.4.3 Wall depth and length.** The depth of the transfer wall shall be 12 inches (305 mm) minimum and 16 inches (406 mm) maximum. The length of the transfer wall shall be 60 inches (1524 mm) minimum and shall be centered on the clear deck space.

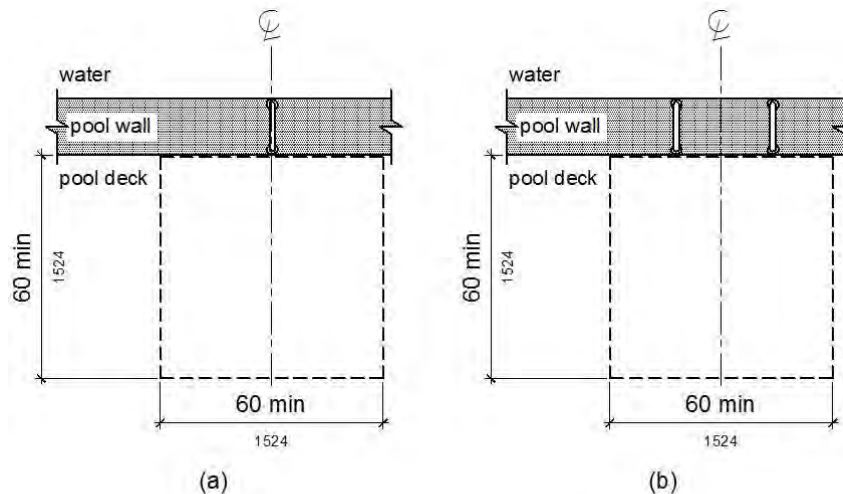
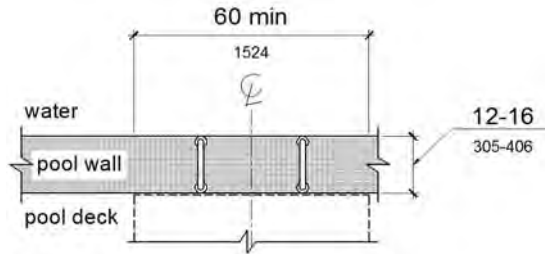


FIGURE 11B-1009.4.1  
CLEAR DECK SPACE AT TRANSFER WALLS

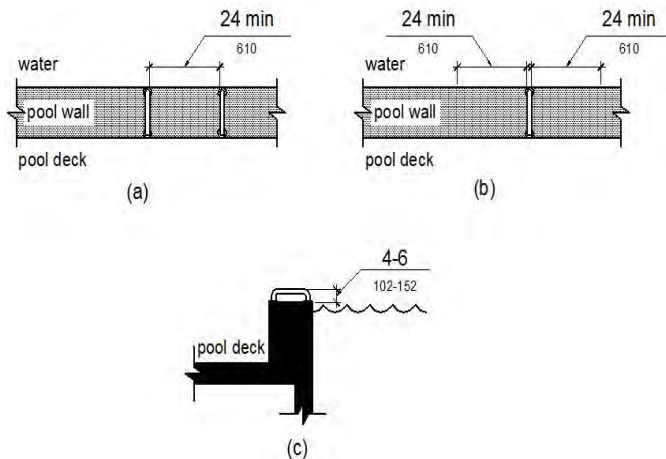




**FIGURE 11B-1009.4.3**  
**DEPTH AND LENGTH OF TRANSFER WALLS**

**11B-1009.4.4 Surface.** Surfaces of transfer walls shall not be sharp and shall have rounded edges.

**11B-1009.4.5 Grab bars.** At least one grab bar complying with *Section 11B-609* shall be provided on the transfer wall. Grab bars shall be perpendicular to the pool wall and shall extend the full depth of the transfer wall. The top of the gripping surface shall be 4 inches (102 mm) minimum and 6 inches (152 mm) maximum above transfer walls. Where one grab bar is provided, clearance shall be 24 inches (610 mm) minimum on both sides of the grab bar. Where two grab bars are provided, clearance between grab bars shall be 24 inches (610 mm) minimum.

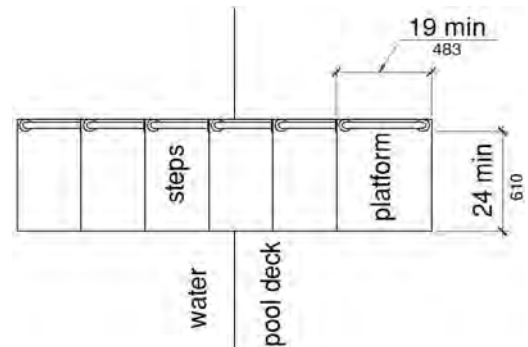


**FIGURE 11B-1009.4.5**  
**GRAB BARS FOR TRANSFER WALLS**

**Exception:** Grab bars on transfer walls shall not be required to comply with *Section 11B-609.4*.

**11B-1009.5 Transfer systems.** Transfer systems shall comply with *Section 11B-1009.5*.

**11B-1009.5.1 Transfer platform.** A transfer platform shall be provided at the head of each transfer system. Transfer platforms shall provide 19 inches (483 mm) minimum clear depth and 24 inches (610 mm) minimum clear width.



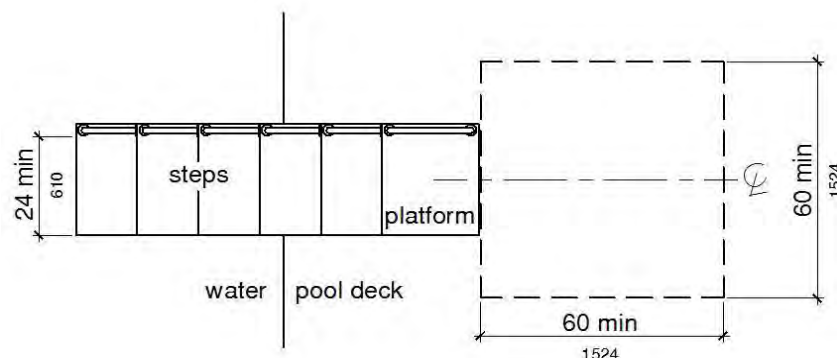
**FIGURE 11B-1009.5.1**  
**SIZE OF TRANSFER PLATFORM**

**11B-1009.5.2 Transfer space.** A transfer space of 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum with a slope not steeper than 1:48 shall be provided at the base of the transfer platform surface and shall be centered along a 24 inch (610 mm) minimum side of the transfer platform. The side of the transfer platform serving the transfer space shall be unobstructed.

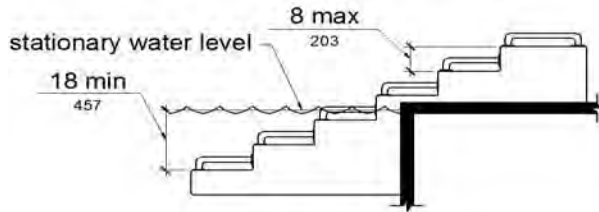
**11B-1009.5.3 Height.** The height of the transfer platform shall comply with *Section 11B-1009.4.2*.

**11B-1009.5.4 Transfer steps.** Transfer step height shall be 8 inches (203 mm) maximum. The surface of the bottom tread shall extend to a water depth of 18 inches (457 mm) minimum below the stationary water level.

**11B-1009.5.5 Surface.** The surface of the transfer system shall not be sharp and shall have rounded edges.

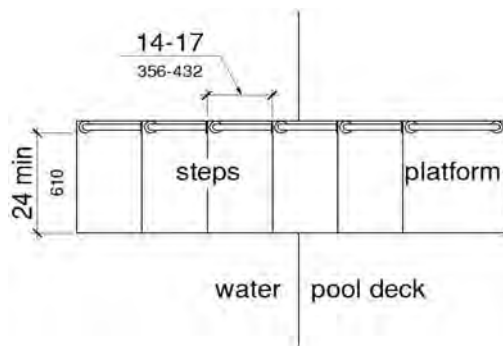


**FIGURE 11B-1009.5.2**  
**CLEAR DECK SPACE AT TRANSFER PLATFORM**



**FIGURE 11B-1009.5.4**  
**TRANSFER STEPS**

**11B-1009.5.6 Size.** Each transfer step shall have a tread clear depth of 14 inches (356 mm) minimum and 17 inches (432 mm) maximum and shall have a tread clear width of 24 inches (610 mm) minimum.



**FIGURE 11B-1009.5.6**  
**SIZE OF TRANSFER STEPS**

**11B-1009.5.7 Grab bars.** At least one grab bar on each transfer step and the transfer platform or a continuous grab bar serving each transfer step and the transfer platform shall be provided. Where a grab bar is provided on each step, the tops of gripping surfaces shall be 4 inches (102 mm) minimum and 6 inches (152 mm) maximum above

each step and transfer platform. Where a continuous grab bar is provided, the top of the gripping surface shall be 4 inches (102 mm) minimum and 6 inches (152 mm) maximum above the step nosing and transfer platform. Grab bars shall comply with *Section 11B-609* and be located on at least one side of the transfer system. The grab bar located at the transfer platform shall not obstruct transfer.

**Exception:** Grab bars on transfer systems shall not be required to comply with *Section 11B-609.4*.

**11B-1009.6 Pool stairs.** Pool stairs shall comply with *Section 11B-1009.6*.

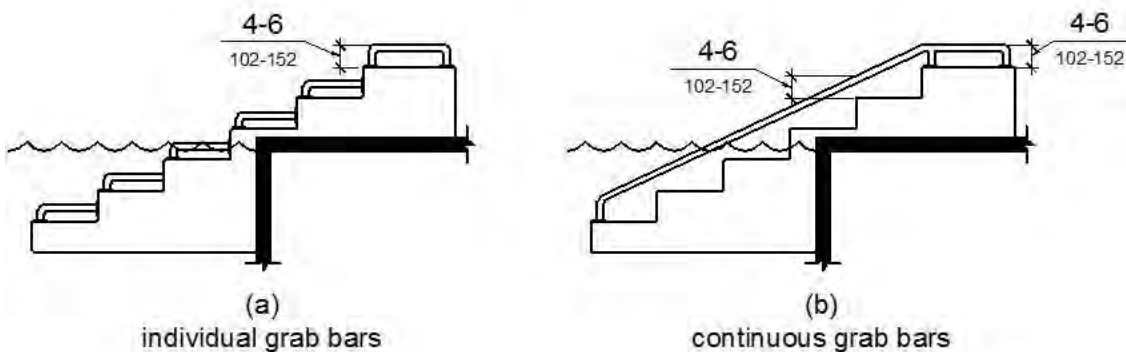
**11B-1009.6.1 Pool stairs.** Pool stairs shall comply with *Section 11B-504*.

**Exception:** Pool step riser heights shall not be required to be 4 inches (102 mm) high minimum and 7 inches (178 mm) high maximum provided that riser heights are uniform.

**11B-1009.6.2 Handrails.** The width between handrails shall be 20 inches (508 mm) minimum and 24 inches (610 mm) maximum. Handrail extensions required by *Section 11B-505.10.3* shall not be required on pool stairs.

**11B-1010 Shooting facilities with firing positions**

**11B-1010.1 Turning space.** A circular turning space 60 inches (1524 mm) diameter minimum with slopes not steeper than 1:48 shall be provided at shooting facilities with firing positions.



**FIGURE 11B-1009.5.7**  
**GRAB BARS**

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 12 – INTERIOR ENVIRONMENT

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>							X	X												
<i>Adopt entire chapter as amended (amended sections listed below)</i>	X		X	X					X	X	X	X								
<i>Adopt only those sections that are listed below</i>		X																X		
<i>Chapter / Section</i>																				
1203.1									X	X	X	X								
1203.1.1																		X		
1203.3.2																		X		
1203.4			X	X																
1203.4.2.1			X	X																
1203.5		X	X	X																
1204.1			X	X																
1204.1 w/Excs/			X						X	X	X	X								
1205.1			X	X																
1205.6	X																			
1206		X																		
1207.1-1207.3; 1207.4-1207.13			X	X																
1208		X																		
1208.1			X																	
1208.2									X	X	X	X								
1208.2.1									X	X	X	X								
1208.4			X																	
1209		X																		
1209.1.1																		X		
1210.2			X	X																
1211-1211.6			X	X																
1224									X											
1225										X										
1226											X									
1227												X								
1230													X							
1231													X							

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 111.*



## CHAPTER 12

# INTERIOR ENVIRONMENT

### SECTION 1201 GENERAL

**1201.1 Scope.** The provisions of this chapter shall govern ventilation, temperature control, lighting, yards and courts, sound transmission, room dimensions, surrounding materials and rodent proofing associated with the interior spaces of buildings.

### SECTION 1202 DEFINITIONS

**1202.1 General.** The following terms are defined in Chapter 2:

**SUNROOM.**

**THERMAL ISOLATION.**

### SECTION 1203 VENTILATION

**1203.1 General.** Buildings shall be provided with natural ventilation in accordance with Section 1203.4, or mechanical ventilation in accordance with the *California Mechanical Code*.

**1203.2 Attic spaces.** Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. An airspace of not less than 1 inch (25 mm) shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than 1/150<sup>th</sup> of the area of the space ventilated.

#### Exceptions:

1. **(Not adopted by HCD)** The net free cross-ventilation area shall be permitted to be reduced to 1/300 provided that not less than 50 percent and not more than 80 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.
2. **(Not adopted by HCD)** The net free cross-ventilation area shall be permitted to be reduced to 1/300 where a Class I or II vapor barrier is installed on the warm-in-winter side of the ceiling.
3. Attic ventilation shall not be required when determined not necessary by the building official due to atmospheric or climatic conditions.

4. **[HCD 1 & HCD 2]** The net cross-ventilation area shall be permitted to be reduced to 1/300, provided that at least 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located no more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

5. **[HCD 1 & HCD 2]** The net cross-ventilation area shall be permitted to be reduced to 1/300 in Climate Zones 14 and 16, where a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.

**1203.2.1 Openings into attic.** Exterior openings into the attic space of any building intended for human occupancy shall be protected to prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. Openings for ventilation having a least dimension of not less than 1/16 inch (1.6 mm) and not more than 1/4 inch (6.4 mm) shall be permitted. Openings for ventilation having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of not less than 1/16 inch (1.6 mm) and not more than 1/4 inch (6.4 mm). Where combustion air is obtained from an attic area, it shall be in accordance with Chapter 7 of the *California Mechanical Code*.

**1203.3 Under-floor ventilation.** The space between the bottom of the floor joists and the earth under any building except spaces occupied by basements or cellars shall be provided with ventilation openings through foundation walls or exterior walls. Such openings shall be placed so as to provide cross ventilation of the under-floor space.

**1203.3.1 Openings for under-floor ventilation.** The net area of ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m<sup>2</sup> for each 100 m<sup>2</sup>) of crawl-space area. Ventilation openings shall be covered for their height and width with any of the following materials, provided that the least dimension of the covering shall be not greater than 1/4 inch (6 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grilles or gratings.
4. Extruded load-bearing vents.

5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension not greater than  $\frac{1}{8}$  inch (3.2 mm).

**1203.3.1.1 [SPCB]** Openings for under-floor ventilation shall be not less than  $1\frac{1}{2}$  square feet (0.135 m<sup>2</sup>) for each 25 linear feet (7620 linear mm) of exterior wall. They shall be covered with corrosion-resistant wire mesh with mesh openings not less than  $\frac{1}{4}$  inch (6.4 mm) nor more than  $\frac{1}{2}$  inch (13 mm) in any dimension.

**1203.3.2 Exceptions.** The following are exceptions to Sections 1203.3 and 1203.3.1:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings is permitted to be reduced to  $\frac{1}{1,500}$  of the under-floor area where the ground surface is covered with a Class I vapor retarder material and the required openings are placed so as to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited.
3. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cubic foot per minute (cfm) for each 50 square feet (1.02 L/s for each 10 m<sup>2</sup>) of crawl space floor area and the ground surface is covered with a Class I vapor retarder.
4. Ventilation openings are not required where the ground surface is covered with a Class I vapor retarder, the perimeter walls are insulated and the space is conditioned in accordance with the *California Energy Code*.
5. For buildings in flood hazard areas as established in Section 1612.3, the openings for under-floor ventilation shall be deemed as meeting the flood opening requirements of ASCE 24 provided that the ventilation openings are designed and installed in accordance with ASCE 24.
6. [SPCB] For purposes of structural pest control inspections, ventilation shall be considered inadequate when the lack thereof has contributed to the growth of wood-destroying pests or organisms.

**1203.4 Natural ventilation.** Natural ventilation of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

**[HCD 1]** In employee housing, all openable windows in rooms used for living, dining, cooking or sleeping purposes, and toilet and bath buildings, shall be provided and maintained with insect screening.

**[HCD 1]** Door openings of rooms used for dining, cooking, toilet and bathing facilities in employee housing shall be provided and maintained with insect screening or with solid

doors equipped with self-closing devices in lieu thereof, when approved by the enforcement agency.

**[HCD 1]** The windows, doors, louvers or other approved closeable openings not required by Section 1029 may open into a passive solar energy collector for ventilation required by this section. The area of ventilation openings to the outside of the passive solar energy collector shall be increased to compensate for the openings required by the interior space.

**1203.4.1 Ventilation area required.** The openable area of the openings to the outdoors shall be not less than 4 percent of the floor area being ventilated.

**1203.4.1.1 Adjoining spaces.** Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m<sup>2</sup>). The openable area of the openings to the outdoors shall be based on the total floor area being ventilated.

**Exception:** Exterior openings required for ventilation shall be permitted to open into a sunroom with thermal isolation or a patio cover provided that the openable area between the sunroom addition or patio cover and the interior room shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 20 square feet (1.86 m<sup>2</sup>). The openable area of the openings to the outdoors shall be based on the total floor area being ventilated.

**1203.4.1.2 Openings below grade.** Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

**1203.4.2 Contaminants exhausted.** Contaminant sources in naturally ventilated spaces shall be removed in accordance with the *California Mechanical Code* and the *California Fire Code*.

**1203.4.2.1 Bathrooms.** Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated in accordance with the *California Mechanical Code*.

The minimum exhaust rate shall not be less than that established by Table 403.7 "Minimum Exhaust Rates." See *California Mechanical Code*, Chapter 5, for additional provisions related to environmental air ducts.

**[HCD 1]** In addition to the requirements in this section and in the *California Mechanical Code*, bathrooms in Group R occupancies shall be mechanically ventilated in accordance with the *California Green Building Standards Code (CALGreen)*, Chapter 4, Division 4.5.

**1203.4.3 Openings on yards or courts.** Where natural ventilation is to be provided by openings onto yards or courts, such yards or courts shall comply with Section 1206.

**1203.5 Other ventilation and exhaust systems.** Ventilation and exhaust systems for occupancies and operations involving flammable or combustible hazards or other contaminant sources as covered in the *California Mechanical Code* or the *California Fire Code* shall be provided as required by both codes.

## SECTION 1204 TEMPERATURE CONTROL

**1204.1 Equipment and systems.** Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining an indoor temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above the floor on the design heating day.

### Exceptions:

1. Space heating systems are not required for interior spaces where the primary purpose of the space is not associated with human comfort.
2. *[HCD 1] For limited-density owner-built rural dwellings, a heating facility or appliance shall be installed in each dwelling subject to the provisions of Subchapter 1, Chapter 1, Title 25, California Code of Regulations, commencing with Section 74; however, there shall be no specified requirement for heating capacity or temperature maintenance. The use of solid-fuel or solar-heating devices shall be deemed as complying with the requirements of this section. If nonrenewable fuel is used in these dwellings, rooms so heated shall meet current installation standards.*
3. *[OSHPD 1, 2, 3 & 4] Space heating systems shall comply with the requirements of the California Mechanical Code.*
4. *[HCD 1] When a passive solar energy collector is designed as a conditioned area it shall comply with the California Energy Code, Title 24, Part 6. Non-conditioned passive solar energy collectors are exempt from Title 24, Part 6.*

## SECTION 1205 LIGHTING

**1205.1 General.** Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with Section 1205.2 or shall be provided with artificial light in accordance with Section 1205.3. Exterior glazed openings shall open directly onto a public way or onto a yard or court in accordance with Section 1206.

*[HCD 1] Glazed openings may open into a passive solar energy collector provided the area of exterior glazed openings in the passive solar energy collector is increased to compensate for the area required by the interior space.*

**1205.2 Natural light.** The minimum net glazed area shall be not less than 8 percent of the floor area of the room served.

**1205.2.1 Adjoining spaces.** For the purpose of natural lighting, any room is permitted to be considered as a portion of an adjoining room where one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet (2.32 m<sup>2</sup>), whichever is greater.

**Exception:** Openings required for natural light shall be permitted to open into a sunroom with thermal isolation or a patio cover where the common wall provides a glazed area of not less than one-tenth of the floor area of the interior room or 20 square feet (1.86 m<sup>2</sup>), whichever is greater.

**1205.2.2 Exterior openings.** Exterior openings required by Section 1205.2 for natural light shall open directly onto a public way, yard or court, as set forth in Section 1206.

### Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch:
  - 1.1. Abuts a public way, yard or court;
  - 1.2. Has a ceiling height of not less than 7 feet (2134 mm); and
  - 1.3. Has a longer side at least 65 percent open and unobstructed.
2. Skylights are not required to open directly onto a public way, yard or court.

**1205.3 Artificial light.** Artificial light shall be provided that is adequate to provide an average illumination of 10 footcandles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

**1205.4 Stairway illumination.** Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than 1 footcandle (11 lux). Stairs in other occupancies shall be governed by Chapter 10.

**1205.4.1 Controls.** The control for activation of the required stairway lighting shall be in accordance with the *California Electrical Code*.

**1205.5 Emergency egress lighting.** The means of egress shall be illuminated in accordance with Section 1006.1.

**1205.6 Campus lighting for parking facilities and primary walkways at California state universities, colleges and community colleges.** Artificial light shall be provided for parking facilities and primary walkways at California State Universities, colleges and community colleges in accordance with provisions of this subsection. This subsection shall not apply to the University of California unless the Regents of the University of California, by resolution, make it applicable.

**1205.6.1 Lighting requirements.** Based on the recommendations of the most current edition of the Illumination Engineering Society lighting handbook, the following lighting standards shall be used for all new construction of open parking facilities, covered parking facilities and primary walkways:

1. Open and covered parking facilities.

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- 1.1. Medium-level activity usage when medium usage is present.*
- 1.2. High-level activity usage when high usage is present.*
- 2. *Primary campus walkways.*
  - 2.1. Medium-level activity usage when medium usage is present.*
  - 2.2. High-level activity usage when high usage is present.*

### SECTION 1206 YARDS OR COURTS

**1206.1 General.** This section shall apply to yards and courts adjacent to exterior openings that provide natural light or ventilation. Such yards and courts shall be on the same lot as the building.

**1206.2 Yards.** Yards shall be not less than 3 feet (914 mm) in width for buildings two stories or less above grade plane. For buildings more than two stories above grade plane, the minimum width of the yard shall be increased at the rate of 1 foot (305 mm) for each additional story. For buildings exceeding 14 stories above grade plane, the required width of the yard shall be computed on the basis of 14 stories above grade plane.

**1206.3 Courts.** Courts shall be not less than 3 feet (914 mm) in width. Courts having windows opening on opposite sides shall be not less than 6 feet (1829 mm) in width. Courts shall be not less than 10 feet (3048 mm) in length unless bounded on one end by a public way or yard. For buildings more than two stories above grade plane, the court shall be increased 1 foot (305 mm) in width and 2 feet (610 mm) in length for each additional story. For buildings exceeding 14 stories above grade plane, the required dimensions shall be computed on the basis of 14 stories above grade plane.

**1206.3.1 Court access.** Access shall be provided to the bottom of courts for cleaning purposes.

**1206.3.2 Air intake.** Courts more than two stories in height shall be provided with a horizontal air intake at the bottom not less than 10 square feet (0.93 m<sup>2</sup>) in area and leading to the exterior of the building unless abutting a yard or public way.

**1206.3.3 Court drainage.** The bottom of every court shall be properly graded and drained to a public sewer or other approved disposal system complying with the *California Plumbing Code*.

### SECTION 1207 SOUND TRANSMISSION

**1207.1 Scope.** This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between dwelling units and adjacent public areas such as halls, corridors, stairs or service areas.

**1207.2 Air-borne sound.** Walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from

public or service areas shall have a sound transmission class (STC) of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E 90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to dwelling unit entrance doors; however, such doors shall be tight fitting to the frame and sill.

**1207.2.1 Masonry.** The sound transmission class of concrete masonry and clay masonry assemblies shall be calculated in accordance with TMS 0302 or determined through testing in accordance with ASTM E 90.

**1207.3 Structure-borne sound.** Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 (45 if field tested) when tested in accordance with ASTM E 492.

### SECTION 1208 INTERIOR SPACE DIMENSIONS

**1208.1 Minimum room widths.** Habitable spaces, other than a kitchen, shall be not less than 7 feet (2134 mm) in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet (914 mm) between counter fronts and appliances or counter fronts and walls.

*[HCD 1] For limited-density owner-built rural dwellings, there shall be no requirements for room dimensions, provided there is adequate light and ventilation and adequate means of egress.*

**1208.2 Minimum ceiling heights.** Occupiable spaces, *habitable spaces* and *corridors* shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall be permitted to have a ceiling height of not less than 7 feet (2134 mm).

#### Exceptions:

1. In one- and two-family dwellings, beams or girders spaced not less than 4 feet (1219 mm) on center shall be permitted to project not more than 6 inches (152 mm) below the required ceiling height.
2. If any room in a building has a sloped ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than 5 feet (1524 mm) from the finished floor to the ceiling shall not be included in any computation of the minimum area thereof.
3. *Mezzanines* constructed in accordance with Section 505.1.
4. *[OSHPD 1, 2 & 3] Minimum ceiling heights shall comply with Section 1224.4.10.* ||
5. *[OSHPD 4] Minimum ceiling heights shall comply with Section 1227.8* ||

**1208.2.1 Furred ceiling.** Any room with a furred ceiling shall be required to have the minimum ceiling height in



two-thirds of the area thereof, but in no case shall the height of the furred ceiling be less than 7 feet (2134 mm).

**1208.3 Room area.** Every dwelling unit shall have no fewer than one room that shall have not less than 120 square feet (13.9 m<sup>2</sup>) of net floor area. Other habitable rooms shall have a net floor area of not less than 70 square feet (6.5 m<sup>2</sup>).

**Exception:** Kitchens are not required to be of a minimum floor area.

> **1208.4 Efficiency dwelling units. [HCD 1]** *Unless modified by local ordinance pursuant to Health and Safety Code Section 17958.1, efficiency dwelling units shall comply with the following:*

1. The unit shall have a living room of not less than 220 square feet (20.4 m<sup>2</sup>) of floor area. An additional 100 square feet (9.3 m<sup>2</sup>) of floor area shall be provided for each occupant of such unit in excess of two.
2. The unit shall be provided with a separate closet.
3. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

## SECTION 1209 ACCESS TO UNOCCUPIED SPACES

**1209.1 Crawl spaces.** Crawl spaces shall be provided with no fewer than one access opening which shall be not less than 18 inches by 24 inches (457 mm by 610 mm).

**1209.1.1 [SPCB]** *Accessible under-floor areas shall be provided with an 18-inch by 24-inch (457 mm by 610 mm) access crawl hole. Pipes, ducts and other nonstructural construction shall not interfere with the accessibility to or within under-floor areas.*

**1209.2 Attic spaces.** An opening not less than 20 inches by 30 inches (559 mm by 762 mm) shall be provided to any attic area having a clear height of over 30 inches (762 mm). Clear headroom of not less than 30 inches (762 mm) shall be provided in the attic space at or above the access opening.

**1209.3 Mechanical appliances.** Access to mechanical appliances installed in under-floor areas, in attic spaces and on roofs or elevated structures shall be in accordance with the *California Mechanical Code*.

## SECTION 1210 TOILET AND BATHROOM REQUIREMENTS

**[P] 1210.1 Required fixtures.** The number and type of plumbing fixtures provided in any occupancy shall comply with the *California Plumbing Code*.

**1210.2 Finish materials.** Walls, floors and partitions in toilet and bathrooms shall comply with Sections 1210.2.1 through 1210.2.4.

**1210.2.1 Floors and wall bases.** In other than dwelling units, toilet, bathing and shower room floor finish materials shall have a smooth, hard, nonabsorbent surface. The intersections of such floors with walls shall have a smooth, hard, nonabsorbent vertical base that extends upward onto the walls not less than 4 inches (102 mm).

**1210.2.2 Walls and partitions.** Walls and partitions within 2 feet (610 mm) of service sinks, urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of not less than 4 feet (1219 mm) above the floor, and except for structural elements, the materials used in such walls shall be of a type that is not adversely affected by moisture.

**Exception:** This section does not apply to the following buildings and spaces:

1. Dwelling units and sleeping units.
2. Toilet rooms that are not accessible to the public and which have not more than one water closet.

Accessories such as grab bars, towel bars, paper dispensers and soap dishes, provided on or within walls, shall be installed and sealed to protect structural elements from moisture.

**1210.2.3 Showers.** Shower compartments and walls above bathtubs with installed shower heads shall be finished with a smooth, nonabsorbent surface to a height not less than 70 inches (1778 mm) above the drain inlet.

**1210.2.4 Waterproof joints.** Built-in tubs with showers shall have waterproof joints between the tub and adjacent wall.

**[P] 1210.3 Privacy.** Privacy at water closets and urinals shall be provided in accordance with Sections 1210.3.1 and 1210.3.2.

**[P] 1210.3.1 Water closet compartment.** Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

**Exceptions:**

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

**[P] 1210.3.2 Urinal partitions.** Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide privacy. The walls or partitions shall begin at a height not more than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than

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6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

### Exceptions:

1. Urinal partitions shall not be required in a single-occupant or family or assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.

**1210.4 Toilet room location.** Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

## SECTION 1211 [HCD 1 & HCD 2] GARAGE DOOR SPRINGS

**1211.1 General.** This section shall apply to applications listed in Sections 1.8.2.1.1 and 1.8.2.1.3 regulated by the Department of Housing and Community Development.

**1211.1.1 Extension garage door springs.** Every extension garage door spring sold or offered for sale, whether new or as a replacement, or installed in any garage or carport which is accessory to an apartment house, hotel, motel or dwelling shall conform to the following requirements:

Hard-drawn spring wire shall conform to ASTM A 227 06 (2011) or a more current version, and shall be made by the steel processes described therein, conforming to the chemical composition requirements listed and meeting the standards of steel heat as set forth by the ladle analysis. Wire tensile strength and dimension variations shall meet the prescribed properties of established standards.

Oil-tempered wire shall conform to ASTM A 229-12 or a more current version, and shall be made by the steel processes described therein, conforming to the chemical composition requirements listed and meeting the standards of steel heat as set forth by the ladle analysis. Wire tensile strength and dimension variations shall meet the prescribed properties of established standards.

Extension springs shall be fabricated from either hard-drawn spring wire or oil-tempered wire as specified above.

**1211.2 Design standards.** Minimum design standard shall be 9,000 cycles. (One cycle is equal to door opening plus door closing at maximum working load.)

### 1211.3 Certification.

Mill certification of wire physical tests and chemical properties shall be kept on file by the spring manufacturer.

Physical cycling tests shall be performed for each extension spring design and shall be certified by an approved testing agency acceptable to the department and reports kept on file by the manufacturer.

Containment devices shall be physically tested for each extension spring design by installing the device on the spring and by destroying the spring at maximum recommended

stretch. Containment tests shall be certified by an approved testing agency acceptable to the department and reports kept on file by the manufacturer.

**1211.4 Containment devices.** Each extension spring shall be equipped with an approved device capable of restraining the spring or any part thereof in the event it breaks.

**1211.5 Identification.** Extension springs shall be permanently identified as to manufacturer and also to indicate maximum recommended stretch. Both extension springs and containment devices shall bear information stating that they have been manufactured in accordance with requirements of the California Department of Housing and Community Development.

**1211.6 Installation.** Installation of extension springs, containment devices and hardware shall be in accordance with the manufacturer's installation instructions. Instructions shall be provided by the manufacturer and shall specify the approved method of restraint and maximum recommended stretch. Unless otherwise permitted by the manufacturer's installation instructions, the hardware and extension springs shall be mounted to nominal 12 by 6 framing members, conforming to the applicable provisions of Section 2303.

## SECTION 1212 [HCD 1] POLLUTANT CONTROL

**1212.1 Finish material pollutant control.** Finish materials, including adhesives, sealants, caulks, paints and coatings, aerosol paints and coatings, carpet systems, carpet cushion, carpet adhesive, resilient flooring systems, and composite wood products shall meet the volatile organic compound (VOC) emission limits in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.

### SECTION 1213 Reserved

### SECTION 1214 Reserved

### SECTION 1215 Reserved

### SECTION 1216 Reserved

### SECTION 1217 Reserved

### SECTION 1218 Reserved

**SECTION 1219**  
**Reserved**

**SECTION 1220**  
**Reserved**

**SECTION 1221**  
**Reserved**

**SECTION 1222**  
**Reserved**

**SECTION 1223**  
**Reserved**

**SECTION 1224 [OSHPD 1]**  
**HOSPITALS**

**1224.1 Scope.** The provisions of this section shall apply to general acute-care hospitals, acute psychiatric hospitals and general acute-care hospitals providing only acute medical rehabilitation center services. The provisions of Section 1225 shall apply to distinct part skilled nursing and intermediate-care services on a general acute-care or acute psychiatric hospital license, provided either in a separate unit or a free-standing building.

**1224.2 Application.** New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, California Fire Code (Parts 3, 4, 5 and 9 of Title 24) and this section.

**Exceptions:**

1. Facilities licensed and in operation prior to the effective date of this section shall not be required to institute corrective alterations or construction to comply with any new requirements imposed thereby or subsequently, except where specifically required or where the enforcing agency determines that a definite hazard to health and safety exists. Facilities for which preliminary drawings have been submitted to the enforcing agency prior to the effective date of this change shall not be required to comply with such new requirements, provided working drawings are submitted within one year of the effective date of such new requirements.
2. The provisions of this section do not prohibit the use of alternate space utilization, new concepts of design, treatment techniques, equipment and alternate finish materials provided the intent of this section is accommodated and written approval for such alternative is granted by the enforcing agency. Written substantiating evidence in support of the alter-

nate and a written request for consideration shall be submitted to the enforcing agency.

3. Nothing in this section shall prohibit the provisions of required services from a centralized service facility serving two or more licensed facilities when approved in writing by the licensing agency. Buildings and required spaces for services provided in a separate centralized services facility shall comply with all applicable provisions of these regulations and applicable local codes and ordinances for the services so provided.
4. Acute psychiatric hospitals and general acute-care hospitals providing only acute medical rehabilitation center services may provide for surgical and anesthesia services to be provided by an outside licensed facility when approved by the licensing agency.
5. When the Corrections Standards Authority, the Department of Corrections or the Department of Youth Authority determines that a particular requirement for hospitals located in a correctional facility may compromise the safety, security or protection of staff, inmates or property, the enforcement agency shall consider an alternate design.

**1224.3 Definitions.**

**AIR CONDITIONING.** The process or system by which simultaneously the temperature, humidity, air motion and quality are maintained within required limits.

**AIRBORNE INFECTION ISOLATION ROOM.** A single-occupancy patient room where environmental factors are controlled in an effort to minimize the transmission of those infectious agents usually spread from person to person by droplet nuclei associated with coughing and inhalation.

**AMBULATORY CARE.** A defined health care encounter(s) of less than 24 hours in duration that requires direct professional health care support within a specific facility.

**AMBULATORY SURGICAL FACILITY.** Any surgical facility organized for the purpose of providing procedural, invasive surgical care to patients with the expectation that they will be recovered sufficiently to be discharged in less than a 24-hour period.

**BASIC SERVICES.** Those essential services required for licensure as a hospital, including medical, nursing, surgical, anesthesia, laboratory, radiology, pharmacy, dietary services and support services. See "SUPPLEMENTAL SERVICES."

**BIOTERRORISM.** The use, or threat of use, of biological agents to intimidate a political entity or population group.

**CENTRAL AIR-HANDLING SYSTEMS.** Any units requiring ductwork on the supply or inlet side and serving more than one room.

**COURT.** An open exterior space bounded on three or more sides by the walls of a structure.

**ENVIRONMENT OF CARE.** Those features in a built health care entity that are created, structured, and maintained to support quality health care.

**EXAM ROOM.** A room with a bed, stretcher, or examination table and capability for periodic monitoring (e.g., measurement of blood pressure or pulse oximetry) in which procedures that do not require a specialized suite can be performed (e.g., pelvic examination, blood transfusion).

**FLOOR AREA, CLEAR.** The actual occupied area exclusive of fixed or wall-mounted cabinets, built-in shelves, toilet rooms, closets, lockers, wardrobes, alcoves, anterooms or vestibules.

**GENERAL ACUTE-CARE HOSPITAL.** A hospital, licensed by the Department of Health Services, having a duly constituted governing body with overall administrative and professional responsibility and an organized medical staff which provides 24-hour inpatient care, including the basic services.

**HANDWASHING FIXTURE.** Refer to the California Plumbing Code, Section 210.0.

**HOSPITAL.** A general acute-care hospital, including those providing only acute medical rehabilitation center services and acute psychiatric hospitals.

**HOUSEKEEPING.** Services anywhere within a health care facility that include general cleaning and tidying and the provision and positioning of identified materials, e.g., soaps, towels, etc. (While routine disinfection protocols can be included in such a definition, the definition is not intended to include complex, nonroutine disinfection procedures nor the nonroutine disposition of hazardous materials such as potentially toxic drugs or other chemicals and radioactive wastes.)

**LDR.** Labor, Delivery, Recovery (an unlicensed patient bed)

**LDRP.** Labor, Delivery, Recovery, Postpartum (a licensed patient bed)

**LICENSING AGENCY.** The Department of Public Health, Licensing and Certification.

**MONOLITHIC.** A surface free of fissures, cracks, perforations, and crevices.

**MONOLITHIC CEILING.** A ceiling constructed with a surface free of fissures, cracks, and crevices. Any penetrations such as lights, diffusers, and access panels shall be sealed or gasketed. Lay-in ceilings are not considered "monolithic."

**NURSING UNIT.** A designated patient care area of the hospital which is planned, organized, operated and maintained to function as a unit. It includes patient rooms with adequate support facilities, services and personnel providing nursing care and necessary management of patients.

**OPERATING ROOM.** A room specifically designed for the performance of surgical procedures. (In common understanding, this means most types of surgical procedures, especially those involving the administration of anesthesia, multiple personnel, recovery room access, and a fully controlled environment.)

**OUTPATIENT SERVICE.** An organizational unit of the hospital, which provides nonemergency healthcare services to patients.

**PATIENT ROOM.** Licensed patient bed rooms.

**PERIOPERATIVE.** Patient care and other related supportive activities before, during or after the operative event.

**PROTECTIVE ENVIRONMENT.** A bedded unit or patient room where severely immunosuppressed patients are cared for.

**RESTRICTED AREA.** A designated space with limited access eligibility. Such space has one or more of the following attributes: specific signage, physical barriers, security controls and protocols that delineate requirements for monitoring, maintenance, attire, and use. The term is often applied to specialized procedure suites, such as operating rooms and suites, interventional imaging, cardiac catheterization labs, angiography suites, etc.

**SCRUB SINK.** A sink used to wash and scrub the hands and arms during the aseptic preparation for surgery, and equipped with a supply spout and controls as required for a handwashing fixture.

**SERVICE SINK.** A sink located in a housekeeping room and designed for the purpose of cleaning mops and the disposal of waste water.

**SUB-ACUTE CARE.** A segment within a continuum of levels of care determined by patient acuity, clinical stability, and resource needs.

**SUPPLEMENTAL SERVICE.** An inpatient or outpatient service which is not required to be provided by law or regulation for licensure. A supplemental service, when provided, must accommodate the provisions of this section.

**Note:** See "BASIC SERVICES."

**SURGICAL SERVICE SPACE.** A space that includes the operating room(s) and service areas.

#### 1224.4 GENERAL CONSTRUCTION.

**1224.4.1 Services/systems and utilities.** See Section 3416A or 3424 for single-story light frame skilled nursing facilities and intermediate care facilities.

**1224.4.2 Service spaces.** Spaces for dietary, laundry, morgue, ambulance entrance, receiving areas, power plants, mechanical equipment, incinerator, garbage can cleaning, automobile parking and storage areas for garbage, trash and medical gases shall be located and constructed to minimize noise, steam, odors, hazards and unsightliness in patient-care areas and bedrooms.

**1224.4.3 Treatment spaces.** Radiology, laboratory, pharmacy, physical therapy and service spaces serving only outpatients and similar outpatient service departments shall not be located in nursing units, surgical units, perinatal units, nursery areas, central sterilization rooms, food-service' areas, power plants, mechanical equipment rooms, maintenance shops, general storage, laundry, employees' dressing or housekeeping facilities.

**Exception:** Physical and occupational therapy spaces of a rehabilitation service may serve both outpatients and inpatients.

#### 1224.4.4 Support areas for patients.

**1224.4.4.1 Examination or treatment room.** Unless specified elsewhere, if a treatment room or an exam

room is provided, it shall have a minimum clear floor area of 80 square feet (7.4 m<sup>2</sup>), the least dimension of which shall be 8 feet (2438mm). The room shall contain a handwashing fixture.

**1224.4.4.1.1 Airborne infection isolation exam/treatment room.** When provided, the airborne infection isolation room shall be an exam/treatment room, shall be labeled with the words "Airborne Infection Room", and provide the following:

1. Capacity. Each airborne infection isolation exam/treatment room shall contain only one examination table or recliner.
2. Handwashing station. A handwashing station shall be located in each airborne infection isolation exam/treatment room.
3. Gowning and storage area. An area for gowning and storage of clean and soiled materials shall be located directly outside or inside the entry door to the airborne infection isolation exam/treatment room.
4. Doors. Room doors shall be self-closing and include latching devices.
5. Sealed-tight room. Room perimeter walls, ceiling, floors, doors and penetration shall be sealed tightly to minimize air infiltration from the outside or from other spaces.
6. Ventilation. The ventilation shall be provided as required by the California Mechanical Code for airborne infection isolation room.

**1224.4.4.1.1.1 Airborne infection isolation exam/treatment anteroom.** An airborne infection isolation anteroom is not required; however, when an anteroom is provided, it shall meet the following requirements:

1. The anteroom shall provide space for persons to don personal protective equipment before entering the patient room.
2. All doors to the anteroom shall have self-closing devices.
3. The anteroom shall provide storage of personal protective equipment (e.g. respirators, gowns, gloves) and clean equipment.
4. Ventilation shall be provided in the anteroom as required by the California Mechanical Code for airborne infection isolation anteroom.

**1224.4.4.2 Specimen and blood collection facilities.**

**1224.4.4.2.1 Specimen collection facilities.** When provided, specimen collection facilities shall comply with the following requirements:

1. Urine collection rooms shall be equipped with a water closet and handwashing station.

**Exception:** The handwashing station may be located immediately outside the collection room when the specimen is used for drug testing.

2. Use of the toilet room provided within the examination and treatment room shall be permitted for specimen collection.

**1224.4.4.2.2 Blood collection facilities.** When provided, blood collection facilities shall comply with the following requirements:

1. Space for a chair and work counter shall be provided.
2. A handwashing station shall be provided.

**1224.4.5 Outpatient waiting rooms.** Waiting rooms for outpatients shall provide a seating area and space for wheelchairs and have public corridor access to, or provisions for, public toilet, drinking fountain and telephone.

**Note:** One waiting area may serve more than one department or service.

**1224.4.5.1 Outpatient access.** If x-ray examinations are to be performed on outpatients, outpatient access to the radiological spaces shall not traverse a nursing unit.

**Exception:** Satellite radiology, laboratory, pharmacy, and physical and occupational therapy space serving inpatients may be located in nursing units and inpatient treatment areas.

**1224.4.6 Miscellaneous requirements.**

**1224.4.6.1 Station outlets.** Station outlets for oxygen, vacuum, and medical air shall comply with Table 1224.4.6.1.

**1224.4.6.2 Gas and vacuum systems.** The design, installation and testing of medical gas and vacuum systems shall conform to Table 1224.4.6.1 and NFPA 99.

**1224.4.6.3 Hyperbaric facilities.** The design and construction of hyperbaric facilities shall conform to NFPA 99.

**1224.4.6.4 Laboratories.** The design and construction of hospital laboratories shall conform to NFPA 99.

**1224.4.6.5 Nurse call systems.** The location of nurse call devices shall comply with Table 1224.4.6.5. The design of call systems shall comply with the California Electrical Code, Part 3 of Title 24.

**1224.4.7 Corridors.**

**1224.4.7.1 Width.** The minimum width of corridors and hallways shall be 8 feet (2438 mm).

**Exception:** Patient-care corridors and hallways in hospitals for psychiatric care of patients who are not bedridden shall have a minimum clear and unobstructed width of 6 feet (1829 mm). For the purposes of this section, bedridden patients shall be defined as patients confined to beds who would be transported or evacuated in beds or litters.

**1224.4.7.2 Light traffic.** Service corridors and hallways with anticipated light traffic volume for nonpatient use may be reduced to a width of 5 feet (1524 mm) if approved by the enforcing agency.

**Exception:** Corridors and hallways in administrative and business areas may be reduced to a width of 44 inches (1118 mm).

# INTERIOR ENVIRONMENT

**TABLE 1224.4.6.1  
STATION OUTLETS FOR OXYGEN, VACUUM (SUCTION), AND MEDICAL AIR<sup>1, 6</sup>**

	LOCATIONS	OXYGEN	VACUUM	MEDICAL AIR
1	Patient rooms (medical/surgical unit)	1/bed	1/bed	—
2	Examination or treatment (medical/surgical unit and postpartum care)	1/room	1/room	—
3	Airborne infection isolation or protective environment rooms (medical/surgical unit)	1/bed	1/bed	—
4	Seclusion room (medical/surgical unit and postpartum care)	1/bed	1/bed	—
5	Intensive care (general)	3/bed	3/bed	1/bed
6	Airborne infection isolation	3/bed	3/bed	1/bed
7	Coronary-care service space	3/bed	2/bed	1/bed
8	Pediatric intensive care	3/bed	3/bed	1/bed
9	Newborn intensive care	3/bassinet	3/bassinet	3/bassinet
10	Newborn nursery (full term)	1/4 bassinets <sup>2</sup>	1/4 bassinets <sup>2</sup>	1/4 bassinets <sup>2</sup>
11	Pediatric and adolescent	1/bed	1/bed	1/bed
12	Pediatric nursery	1/bassinet	1/bassinet	1/bassinet
13	Psychiatric patient room	—	—	—
14	Seclusion treatment room	—	—	—
15	General operating room	2/room	3/room	—
16	Cardio, ortho, neurological	2/room	3/room	—
17	Orthopedic surgery	2/room	3/room	—
18	Surgical cysto and endo	1/room	3/room	—
19	Post-anesthesia care unit	1/bed	3/bed	1/bed
20	Anesthesia workroom	1 per workstation	—	1 per workstation
21	Not used	—	—	—
22	Postpartum bedroom	1/bed	1/bed	—
23	Cesarean operating/delivery room	2/room	3/room	1/room
24	Infant resuscitation space <sup>4</sup>	1/bassinet	1/bassinet	1/bassinet
25	Labor room	1/room	1/room	—
26	OB recovery room	1/bed	3/bed	—
27	Labor/delivery/recovery (LDR) <sup>5</sup>	1/bed	1/bed	—
28	Labor/deliver/recovery/postpartum (LDRP) <sup>5</sup>	1/bed	1/bed	—
29	Initial emergency management	1/bed	1/bed	1/bed
30	Triage area (definitive emergency care)	1/station	1/station	—
31	Definitive emergency care examination or treatment rooms	1/bed	1/bed	1/bed
32	Definitive emergency care observation unit	1/bed	1/bed	—
33	Trauma/cardiac room(s)	2/bed	3/bed	1/bed
34	Orthopedic and cast room	1/room	1/room	—
35	Cardiac catheterization lab	2/bed	2/bed	2/bed
36	Autopsy room	—	1 per workstation	—
37	MRI	1/room	1/room	1/room

1. For any area or room not described above, the facility clinical staff shall determine outlet requirements after consultation with the enforcing agency.

2. Four bassinets may share one outlet that is accessible to each bassinet.

3. Not used.

4. When infant resuscitation takes place in a room such as cesarean section/delivery or LDRP, then the infant resuscitation services must be provided in that room in addition to the minimum service required for the mother.

5. One outlet for mother and one for each bassinet.

6. Renovation projects of existing spaces where the existing function is not changed, are not required to comply with the requirements of this table.

**TABLE 1224.4.6.5**  
**[OSHPD 1, 2, 3 & 4] LOCATION OF NURSE CALL DEVICES**  
**KEY: • Required**

AREA DESIGNATION	PATIENT STATION	BATH STATION	STAFF EMERGENCY STATION	CODE CALL STATION	NURSE MASTER STATION	DUTY STATION	NOTE
<b>Nursing Units</b>							
Inpatient bed location	•	•					1, 2, 3, 4
Patient toilets, showers, and baths		•					2
Nurse/control station					•		
Clean workroom						•	
Soiled workroom						•	
Medication preparation room						•	
Examination/treatment room			•			•	
Staff lounge						•	
<b>Other Clinical Areas</b>							
Operating and cesarean delivery rooms			•				2
Procedure rooms			•				2
LDR/LDRP rooms	•		•	•			1, 2, 3, 4
Recovery—PACU			•	•			2, 4
Emergency exam, treatment, triage rooms	•		•	•			1, 2, 4
Patient preparation and holding areas	•		•				1, 2
Critical care bed locations, including NICU	•		•	•			1, 2, 4, 5
Newborn and special care nurseries			•				
Cardiac catheterization, interventional radiology, angiography			•	•			
MRI, CT, stress testing areas			•	•			2, 4
Psychiatric seclusion ante/exam rooms			•				

**Notes:**

1. One device shall be permitted to accommodate both patient station and emergency staff assistance station functionality.
2. A visible signal shall be activated in the corridor at the patient's door, at the nurse/control station, and at all duty stations. In multicorridor nursing units, additional visible signals shall be installed at corridor intersections.
3. Two-way voice communication shall be provided with the nurse/control station.
4. One device shall be permitted to accommodate both emergency staff assistance and code call station functionality.
5. A patient station shall not be required in the NICU.

**1224.4.7.3 Outpatient services.** Outpatient clinics or outpatient departments which contain facilities for outpatient use only, such as laboratory, x-ray, physical therapy or occupational therapy, shall have a minimum corridor or hallway width of 5 feet (1524 mm). Outpatient clinics and outpatient departments consisting only of waiting rooms, business offices, doctor's offices, and examining rooms, where there is no traffic through such area to other services or to exits from the building, shall have a minimum corridor or hallway width of 44 inches (1118 mm).

**1224.4.7.4 Handrails.** Corridors for patient traffic in areas providing skilled nursing, intermediate care or rehabilitation services shall be furnished with a handrail on both sides at a height not less than 30 inches (762 mm) or greater than 36 inches (914 mm).

**1224.4.7.5 Connections.** Corridor systems shall connect all patient rooms and basic services.

**Exception:** Covered pedestrian walkways connecting separate buildings are permitted for ambulatory, psychiatric or chemical dependency patients.

**1224.4.8 Doors and door openings.**

**1224.4.8.1 Toilet room doors.** Doors to toilet rooms shall have an opening of not less than 32 inches (813 mm) clear in width and shall be equipped with hardware which will permit the door to swing outward or in a manner to negate the need to push against a patient who may have collapsed within the toilet room.

**1224.4.8.2 Pocket doors.** Pocket sliding doors are not permitted.

**Exception:** Administration and business areas.

**1224.4.9 Windows and screens.**

**1224.4.9.1 Windows.** Rooms approved for the housing of patients shall be provided with natural light by means of exterior glazed openings excluding clerestory window, obscure glass and skylights, with an area not less than one tenth of the total floor area.

**Exception:** Newborn intensive-care units shall comply with Section 1224.29.2.12 Daylight.

**1224.4.9.2 Operation and sills.** Patient room windows shall have sills not more than 36 inches (914 mm)

above the floor. If operable windows are provided that require the use of tools or keys for operation, the tools or keys shall be located at the nurses' station.

**Exception:** Window sills in intensive-care units may be 60 inches (1524 mm) above the floor.

**1224.4.9.2.1 Airborne infection isolation or protective environment rooms.** If operable windows are provided in airborne infection isolation or protective environment rooms, they shall only be operable by the use of tools or keys which shall be located at the nurses' station.

**1224.4.9.3 Psychiatric unit windows.** Safety glass or plastic glazing materials shall be used in windows in psychiatric patient areas.

**1224.4.9.4 Screens.** Windows which may be frequently left in an open position shall be provided with insect screens of 16 meshes to the inch.

**1224.4.9.5 Light and ventilation.** All portions of a building used by patients, personnel or other persons shall be provided with artificial light and a mechanically operated ventilating system as specified in the California Electrical Code and the California Mechanical Code.

#### **1224.4.10 Ceiling heights.**

**1224.4.10.1 Minimum height.** The minimum height of ceilings shall be 8 feet (2438 mm).

**Exception:** Closet, toilet room and bathroom minimum ceiling heights shall not be less than 7 feet (2134 mm).

**1224.4.10.2 Minimum height with fixed ceiling equipment.** Operating rooms, emergency rooms, delivery rooms, radiographic rooms and other rooms containing ceiling-mounted, major fixed equipment or ceiling-mounted surgical light fixtures shall have ceiling heights to accommodate the equipment or fixtures and their normal movement. Suspended tracks, rails and pipes located in the traffic path for patients in beds and/or on stretchers, including those in inpatient service areas, shall be not less than 7 feet (2134 mm) above the floor.

**Exception:** Mobile suspended tracks such as traverse rails for overhead patient lifts that may be moved out of the traffic path shall provide a clearance of not less than 6 feet, 8 inches (2032mm) above the floor when in use.

#### **1224.4.11 Interior finishes.**

**1224.4.11.1 Floor finishes.** Floor finishes shall be smooth, waterproof and durable. Flooring surfaces shall provide smooth transitions between different floor materials. Slip-resistant flooring products shall be used for flooring surfaces in wet areas (e.g., kitchens,

shower and bath areas), ramps, stairways, entries from exterior to interior space, and other areas as determined by the functional program. Joints for floor openings for pipes, ducts and conduits shall be tightly sealed. Joints of structural elements shall be similarly sealed.

**Exception:** Upon written appropriate documented requests, the licensing agency may grant approval of the installation of carpets. See Table 1224.4.11.

**1224.4.11.1.1 Coved base.** Resilient flooring, if used in toilet and bathing rooms, shall be continuous and extend upward onto the wall at least 5 inches (127 mm) to minimize moisture infiltration. Wood bases are prohibited except in waiting areas and administration departments.

**1224.4.11.1.2 Food preparation areas.** Floors in areas used for food preparation and assembly shall be water-resistant. Floor surfaces, including tile joints, shall be resistant to food acids. Floor construction in dietary and food preparation areas shall be free of spaces that can harbor pests.

**1224.4.11.1.3 Wet cleaning.** In all areas subject to frequent wet-cleaning methods, flooring materials shall not be physically affected by germicidal or other types of cleaning solutions.

**1224.4.11.1.4 Airborne infection isolation, airborne infection isolation exam/treatment and protective environment rooms.** These rooms and anterooms shall have seamless flooring with integral coved base.

#### **1224.4.11.2 Wall bases.**

**1224.4.11.2.1 Material.** The material and textures of bases and the installation thereof shall be such as to minimize dust-catching surfaces, moisture, infiltration and the harboring of vermin.

**Exception:** In locations where carpet is permitted as a floor finish material, the use of carpeted base (coved or strip base) up to a maximum height of 5 inches (127mm) is also permissible.

**1224.4.11.2.2 Wet cleaning.** Floors and wall bases in operating rooms, delivery rooms, emergency operating rooms, cast rooms, interventional rooms and special procedure rooms shall be monolithic and constructed without joints. The floors and wall bases of kitchens, soiled and clean utility rooms, housekeeping rooms with mop sinks, patient, public and staff sanitary facilities and other areas subject to frequent wet cleaning, shall also be homogeneous, but may have tightly sealed joints and shall be constructed without voids at the intersection of floor and wall surfaces.



**TABLE 1224.4.11  
ACCEPTABLE CEILING AND CARPET LOCATIONS**

<b>AREAS/ROOMS <sup>3,4</sup></b>	<b>GENERAL ACUTE CARE HOSPITAL CEILING/CARPET</b>		<b>ACUTE PSYCHIATRIC HOSPITAL CEILING/ CARPET</b>		<b>SKILLED NURSING AND INTERMEDIATE-CARE FACILITIES CEILING/CARPET</b>		<b>CLINIC CEILING/ CARPET</b>	
Patient bedrooms	3	*	3	*	3	*	-	-
Patient corridors/hallways	3	*	3	*	3	*	3	*
Airborne infection isolation rooms	2	N	2	N	2	N	2	N
Protective environment rooms	1	N	1	N	1	N	-	-
Nurses' or administration station	3	Y	3	Y	3	Y	3	Y
Utility rooms	2	N	2	N	2	N	2	N
Surgical units <sup>2</sup>	2	N	-	-	-	-	2	N
Operation rooms	1	N	-	-	-	-	1	N
Surgical corridors/hallways	2	N	-	-	-	-	2	N
Recovery	3	N	-	-	-	-	3	N
Radiological unit <sup>2</sup>	3	*	3	*	-	-	3	-
X-ray rooms <sup>1</sup>	3	N	3	N	-	-	3	N
Treatment rooms <sup>2</sup>	2	N	3	N	2	N	2	N
Examination rooms	3	*	3	*	3	*	3	*
Administration	4	Y	4	Y	4	Y	4	Y
Central sterile supply	2	N	2	N	2	N	2	N
Clinical laboratories	3	N	3	N	-	-	3	N
Pharmacy	3	*	3	*	3	*	3	*
Morgue and autopsy	3	N	-	-	-	-	-	-
General storage rooms	3	N	3	N	3	N	3	N
Housekeeping rooms	2	N	2	N	2	N	2	N
Laundry	1 <sup>5</sup>	N	1 <sup>5</sup>	N	1 <sup>5</sup>	N	-	-
Soiled linen	2	N	3	N	3	N	3	N
Clean linen	3	N	3	N	3	N	3	N
Kitchens	1 <sup>5</sup>	N	1 <sup>5</sup>	N	1 <sup>5</sup>	N	1 <sup>5</sup>	N
Dining rooms	3	*	3	*	3	*	3	*
Dishwasher rooms	2	N	2	N	2	N	2	N
Dietary day storage	2	N	2	N	2	N	-	-
Catheterization laboratory	1	N	-	-	-	-	-	-
Chronic dialysis	3	*	-	-	-	-	3	*
Coronary care	3	*	-	-	-	-	-	-
Dental	3	*	-	-	-	-	3	*
Hydrotherapy	2	N	2	N	2	N	2	N
Intensive-care nursery	3	*	-	-	-	-	-	-
Intensive care	3	*	-	-	-	-	-	-
Occupational therapy	3	*	3	*	3	*	3	*
Obstetrical unit <sup>2</sup>	3	*	-	-	-	-	-	-
Delivery rooms	1	N	-	-	-	-	-	-
Labor rooms, LDRP and LDR	3	N	-	-	-	-	-	-
Nurseries	3	N	-	-	-	-	-	-
Physical therapy	3	*	3	*	3	*	3	*
Radiation therapy	3	*	-	-	-	-	3	*
Speech pathology and audiology	3	Y	3	Y	3	Y	3	Y

**Ceilings:**

1 – Continuous monolithic surface equal in smoothness to enamel plaster.

2 – Smooth and easily cleanable without perforations or fissures.

3 – Pin perforated, fine fissured, or lightly textured.

4 – Any finish meeting code requirements.

**Carpets:**

Yes = Y

No = N

\* Upon approval by the licensing agency with adequate maintenance procedure. However, should the carpet not be maintained adequately, the licensing agency has the right to have it removed and replaced with another acceptable material.

**Footnotes:**

1. Carpet permitted in mammography.

2. Except those rooms specified otherwise.

3. For rooms not listed, contact the Office of Statewide Health Planning and Development (OSHPD).

4. Table applies to new construction, additions, remodels, and conversions. The patching and replacement of existing materials will be permitted.

5. Lay-in ceiling meeting the requirements of Section 1224.4.11.4.1.7 may be substituted in laundry and kitchens.

**1224.4.11.3 Wall finishes.** Wall finishes shall comply with the following requirements:

1. Wall finishes shall be washable. In the vicinity of plumbing fixtures, wall finishes shall be smooth, scrubbable and water-resistant.
2. Wall finishes in areas such as operating rooms, delivery rooms and trauma rooms shall be monolithic, scrubbable and able to withstand cleaning with chemicals.
3. Wall finishes in operating rooms, cesarean delivery rooms, isolation rooms and sterile processing rooms shall be free of fissures, open joints or crevices that may retain or permit passage of dirt particles.
4. Wall finishes in areas such as clean corridors, central sterile supply spaces, specialized radiographic rooms and minor surgical procedure rooms shall be washable, smooth and able to withstand cleaning with chemicals.
5. Wall areas penetrated by pipes, ducts and conduits shall be tightly sealed to minimize entry of rodents and insects. Joints of structural elements shall be similarly sealed.
6. Wall finish requirements of Section 1224.4.11.3 do not apply to boiler rooms, mechanical equipment rooms, administration departments, other offices, enclosed stairways, maintenance shops and similar spaces.

**1224.4.11.3.1 Dietary and food preparation areas.** Dietary and food preparation areas shall comply with the following requirements:

1. In dietary and food preparation areas, wall construction, finish, and trim, including the joints between the walls and the floors, shall be free of spaces that can harbor insects and rodents.
2. Wall surfaces in wet areas (e.g., kitchens, environmental services closets) shall be monolithic and all seams shall be covered and/or sealed.

**1224.4.11.4 Ceilings.** Ceilings in areas occupied by patients and the public shall be cleanable with the use of routine housekeeping equipment. Acoustic and lay-in ceiling, where used, shall not create ledges or crevices.

**1224.4.11.4.1 Ceiling finishes.** Ceiling finishes shall comply with Table 1224.4.11 and the following requirements:

*Semirestricted areas:*

1. Ceiling finishes in semirestricted areas such as airborne infection isolation exam/treatment rooms, surgical corridors, central sterile supply spaces and minor surgical procedure rooms, shall be nonabsorptive, nonperforated, capable of withstanding cleaning with chemicals, and without crev-

ices that can harbor mold and bacterial growth.

2. If a lay-in ceiling is provided in semirestricted areas, it shall be gasketed or each ceiling tile shall weigh at least one pound per square foot to prevent the passage of particles from the cavity above the ceiling plane into the semirestricted environment. Perforated, tegular, serrated cut or highly textured tiles are not acceptable.

*Restricted areas:*

3. Ceilings in restricted areas shall be monolithic with no cracks or perforations.
4. Ceilings in restricted areas shall be scrubbable and able to withstand cleaning and/or disinfecting chemicals.
5. All access openings in restricted area ceilings shall be gasketed.

*Dietary and laundry areas:*

6. Provide either a sealed monolithic and scrubbable gypsum board ceiling or a lay-in ceiling.
7. If a lay-in ceiling is provided, it shall include the following:
  - a) A rust-free grid.
  - b) Ceiling tiles that weigh at least one pound per square foot and are smooth, scrubbable, nonabsorptive, nonperforated and able to withstand cleaning with chemicals.
8. Ceiling finish requirements of Section 1224.4.11.4.1 do not apply to boiler rooms, mechanical equipment rooms, administration departments, other offices, enclosed stairways, maintenance shops and similar spaces.

**1224.4.12 Courts.** Where one or more walls of a court contain a door or window of one or more patients' bedrooms, the least dimension of the court shall be 20 feet (6096 mm) between facing structures.

**1224.4.13 Elevators.**

**1224.4.13.1 Patient.** Patient elevators shall have minimum inside platform dimensions of 5 feet by 8 feet (1524 mm by 2438 mm), and a minimum clear door opening of 4 feet 0 inches (1219 mm).

**1224.4.13.2 Passenger.** Passenger elevators shall have minimum inside platform dimensions of 4 feet 8 inches by 7 feet 4 inches (1422 mm by 2236 mm).

**1224.4.13.3 Patient services.** Buildings over one story in height with accommodations or services for patients on floors without grade-level entrance shall provide at least one patient elevator.

**1224.4.13.4 Low patient capacity.** If bed patients are accommodated on one or more floors, other than the

main entrance floor or where operating rooms or delivery rooms are above or below the main entrance floor, at least one patient elevator shall be provided.

**1224.4.13.5 Medium patient capacity.** At least one patient elevator and one service elevator shall be provided in hospitals with a capacity of from 60 to 149 beds on floors other than the main entrance floor.

**1224.4.13.6 High patient capacity.** At least one patient elevator, one passenger elevator and one service elevator shall be provided in hospitals with a capacity of 150 or more beds on floors other than the main entrance floor.

**1224.4.14 Garbage, solid waste and trash storage.** Rooms or screening enclosures shall be provided for the washing and cleaning of garbage containers and for the storage of garbage, trash and other solid wastes. Such rooms or screening enclosures shall include the following:

1. A concrete floor with a curb and with a drain connected to the sewer.
2. Steam or hot-water and cold-water supply.
3. A minimum floor area of  $1\frac{1}{2}$  square foot ( $0.046\text{ m}^2$ ) per bed, but not less than 25 square feet ( $2.3\text{ m}^2$ ), the least dimension of which shall be 4 feet (1219 mm).
4. A method of limiting access to the material except by authorized persons.

**1224.4.15 Housekeeping room.** This room shall be a minimum floor area of 15 square feet ( $1.4\text{ m}^2$ ). It shall contain a service sink or floor receptor and provisions for storage of supplies and housekeeping equipment.

**1224.4.16 Laundry and trash chutes.** Gravity-type laundry and trash chutes shall have a minimum diameter of 2 feet (610 mm) and shall be designed to prevent distribution of airborne contaminating elements to all floors served.

**1224.4.17 Telephone.** Each floor accommodating patients shall have a telephone installed for patient use. Such telephones shall be readily accessible to patients who are limited to wheel chairs and stretchers. This may not be required in separate buildings having six or fewer beds which are restricted to occupancy by ambulatory patients.

**1224.4.18 Grab bars.** Each toilet, bathtub and shower serving patients shall have conveniently placed grab bars that shall comply with Chapter 11B.

**Exception:** Excluding facilities designed for use by persons with disabilities, grab bars may be deleted from those facilities serving chemical dependency recovery and psychiatric patients.

## 1224.5 NOISE CONTROL.

**1224.5.1 Impact noises.** Recreation rooms, exercise rooms, equipment rooms and similar spaces where impact noises may be generated, shall not be located directly over patient bed areas or delivery and operating suites, unless special provisions are made to minimize such noise.

**1224.5.2 Noise reduction.** The noise reduction criteria shown in Table 1224.5 shall apply to partitions, floors, and ceiling construction in patient areas.

**TABLE 1224.5  
SOUND TRANSMISSION LIMITATIONS  
IN ACUTE CARE GENERAL HOSPITALS**

NEW CONSTRUCTION	AIRBORNE SOUND TRANSMISSION CLASS (STC) <sup>1</sup>	
	Partitions	Floors
Patient room to patient room	45	40
Public space to patient room <sup>3</sup>	55	40
Service areas to patient room <sup>4</sup>	65	45
Patient room access corridor <sup>5</sup>	45	45
Exam room to exam room	45	
Exam room to public space	45	
Toilet room to public space	45	
Consultation rooms/conference rooms to public space	45	
Consultation rooms/conference rooms to patient rooms	45	
Staff lounges to patient rooms	45	

1. Sound Transmission Class (STC) shall be determined by tests in accordance with methods set forth in ASTM 90 and ASTM 413. Where partitions do not extend to the structure above, sound transmission through ceilings and composite STC performance shall be considered.
2. Treatment rooms shall be treated the same as patient rooms.
3. Public space includes corridors (except patient room access corridors), lobbies, dining rooms, recreation rooms, and similar space.
4. Service areas for the purposes of this table include kitchens, elevators, elevator machine rooms, laundries, garages, maintenance rooms, boiler and mechanical equipment rooms, and similar spaces of high noise. Mechanical equipment located on the same floor or above patient rooms, offices, nurses stations, and similar occupied space shall be effectively isolated from the floor.
5. Patient room access corridors contain composite walls with doors/windows and have direct access to patient rooms.
6. Renovation projects of existing spaces where the existing function is not changed, are not required to comply with the requirements of Table 1224.5.

## BASIC SERVICES

**1224.6 Reserved**

**1224.7 Reserved**

**1224.8 Reserved**

**1224.9 Reserved**

**1224.10 Reserved**

**1224.11 Reserved**

**1224.12 Reserved**

**1224.13 Reserved**

**1224.14 NURSING SERVICE SPACE.**

**1224.14.1 Patient rooms.**

**1224.14.1.1 Capacity.** No patient room shall be designed to accommodate more than eight beds.

**1224.14.1.2 Space requirements.** In new construction, patient rooms shall have a minimum of 100 square feet ( $9.29\text{ m}^2$ ) of clear floor area per bed in multiple-bed rooms and 120 square feet ( $11.15\text{ m}^2$ ) of clear floor

area for single-bed rooms. The dimensions and arrangement of rooms shall be such that there is a minimum of 3 feet (914 mm) between the sides and foot of the bed and any wall or any other fixed obstruction. In multiple-bed rooms, a clearance of 4 feet (1219 mm) shall be available at the foot of each bed to permit the passage of equipment and beds.

**Exceptions:**

1. Where renovation of existing patient rooms is undertaken in facilities built under the 2001 or prior California Building Code, patient rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per bed in multiple-bed rooms and 110 square feet (10.22 m<sup>2</sup>) of clear floor area in single-bed rooms.
2. For shelled spaces built under the 2001 or prior California Building Code, patient rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per bed in multiple-bed rooms and 110 square feet (10.22 m<sup>2</sup>) of clear floor area in single-bed rooms.

**1224.14.1.3 Windows.** Each patient room shall have a window in accordance with Section 1224.4.9.

**1224.14.1.4 Arrangement.** Patient rooms shall not be designed to permit the placement of beds more than three deep from the exterior window, but shall be of such shape and dimensions to allow for the performance of routine functions, including the easy transfer of patients to and from bed to wheelchair or wheeled gurney.

**1224.14.1.5 Outside exposure.** All patient bedrooms shall have an outside exposure and shall not be below ground level.

**1224.14.1.6 Handwashing fixtures.** A handwashing fixture shall be provided in the patient room. Water spouts used shall have clearances adequate to avoid contaminating utensils and the contents of carafes, etc. In multiple-bed rooms the handwashing fixture shall be located outside of the patient's cubicle curtain so that it is accessible to staff. Where renovation of patient rooms is undertaken a handwashing fixture shall be located in the toilet room or patient room.

**1224.14.1.7 Toilet room.** Each patient shall have access to a toilet room without having to enter the general corridor area. One toilet room shall serve no more than four beds and no more than two patient rooms. The toilet room shall contain a water closet and a lavatory and the door shall swing outward or be double acting. Unless located in a toilet room, bedpan-washing fixtures shall be installed in dedicated rooms, separate from patient care areas.

**1224.14.1.8 Patient storage.** Each patient shall have within his or her room a separate wardrobe, locker, or closet suitable for hanging full-length garments and for storing personal effects.

**1224.14.1.9 Privacy.** In multiple-bed rooms, visual privacy from casual observation by other patients and vis-

itors shall be provided for each patient. The design for privacy shall not restrict patient access to the entrance, lavatory, or toilet room.

**1224.14.1.10 Grab bars.** Grab bars shall be installed in accordance with Section 1224.4.18.

**1224.14.1.11 Room identification.** Each patient room shall be labeled with an identification number, letter or combination of the two.

**1224.14.2 Service areas.** Unless otherwise indicated, provision for the services listed below shall be in or readily available to each nursing unit. The size and location of each service area will depend upon the numbers and types of beds served. Identifiable spaces are required for each of the indicated functions. Each service area may be arranged and located to serve more than one nursing unit but, unless noted otherwise, at least one such service area shall be provided on each nursing floor. Where the words "room" or "offices" are used, a separate, enclosed space for the one named function is intended; otherwise, the described area may be specific space in another room or common area.

**1224.14.2.1 Administrative center(s) or nurse station(s).** This area shall have space for counters and storage and shall have convenient access to handwashing fixtures. It may be combined with or include centers for reception, charting and communication.

**1224.14.2.2 Nurse or supervisor office.**

**1224.14.2.3 Toilet room(s) conveniently located for staff use.**

**1224.14.2.4 Multipurpose room(s)** for staff, patients, patients' families for patient conferences, reports, education, training sessions, and consultation. These rooms must be accessible to each nursing unit. They may be on other floors if convenient for regular use. One such room may serve several nursing units and/or departments.

**1224.14.2.5 Examination or treatment room(s).** Examination or treatment rooms are optional. If provided, provision shall be made to preserve patient privacy from observation from outside the exam room through an open door.

**1224.14.2.6 Clean utility room.** If the room is used for preparing patient care items, it shall contain a work counter, a handwashing fixture, and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility or holding rooms shall be separated and have no direct connection.

**1224.14.2.7 Soiled workroom or soiled holding room.** This room shall be separate from the clean utility room. The soiled workroom utilities room shall contain a clinical sink (or equivalent flushing-rim fixture). The room shall contain a handwashing fixture. The above fixtures shall both have a hot and cold mixing faucet. The room shall have a work counter and space for separate cov-

ered containers for soiled linen and waste. Rooms used only for temporary holding of soiled material may omit the clinical sink and work counter. If the flushing-rim clinical sink is eliminated, facilities for cleaning bedpans shall be provided elsewhere.

**1224.14.2.8 Medication station.** Provision shall be made for distribution of medications. This shall be done from a medicine preparation room or from a self-contained medicine dispensing unit.

**1224.14.2.8.1 Medicine preparation room.** If provided, this room shall be directly accessible from the nursing station. It shall contain a work counter, handwashing fixture, refrigerator, and locked storage for controlled drugs. When a medicine preparation room is to be used to store one or more self-contained medicine dispensing units, the room shall be designed with adequate space to prepare medicines with the self-contained medicine dispensing unit(s) present.

**1224.14.2.8.2 Self-contained medicine dispensing unit.** If provided, a self-contained medicine dispensing unit shall be located at the nurses' station, in the clean utility room, or in an alcove.

**1224.14.2.9 Clean linen storage.** Each nursing unit shall contain a designated area for clean linen storage. This may be within the clean utility room or a separate closet.

**1224.14.2.10 Nourishment area.** There shall be a nourishment area with sink, work counter, refrigerator, storage cabinets, and equipment for hot and cold nourishment between scheduled meals. The nourishment area shall include space for trays and dishes used for nonscheduled meal service. Provisions and space shall be included for separate temporary storage of unused and soiled dietary trays not picked up at mealtime. Handwashing fixtures separate from the nourishment sink shall be in or adjacent to the nourishment area.

**1224.14.2.11 Ice machine.** Each nursing unit shall have equipment to provide ice for treatments and nourishment. Ice making equipment may be in the clean utility room/holding room or at the nourishment station. Ice intended for human consumption shall be from self-dispensing icemakers.

**1224.14.2.12 Equipment storage room.** Appropriate room(s) shall be provided for storage of equipment necessary for patient care. Each unit shall provide not less than 10 square feet (0.93 m<sup>2</sup>) per patient bed.

**1224.14.2.13 Gurneys and wheelchairs.** Provide a storage room or alcove for gurneys and wheelchairs which shall be a minimum of 15 square feet (1.39 m<sup>2</sup>).

**1224.14.2.14 Showers and bathtubs.** When individual bathing facilities are not provided in patient rooms, there shall be at least one shower and/or bathtub for each 12 beds without such facilities. Each bathtub or shower shall be in an individual room or enclosure that provides privacy for bathing, drying, and dressing. Special bathing facilities, including space for atten-

dant, shall be provided for patients on gurneys, carts, and wheelchairs at the ratio of one per 100 beds or a fraction thereof. This may be on a separate floor if convenient for use.

**1224.14.2.15 Patient toilet room(s),** in addition to those serving bed areas, shall be conveniently located to multipurpose room(s) and within or directly accessible to each central bathing facility.

**1224.14.2.16 Emergency equipment storage.** Space shall be provided for emergency equipment that is under direct control of the nursing staff, such as a cardiopulmonary resuscitation (CPR) cart. This space shall be directly accessible from the nursing station, but out of normal traffic.

**1224.14.2.17 Housekeeping room.**

**1224.14.2.18 Grab bars.** Grab bars shall be installed in accordance with Section 1224.4.18.

### **1224.14.3 Airborne infection isolation rooms.**

**1224.14.3.1 General.** Single rooms shall be provided for the isolation of patients with airborne communicable disease at a ratio of one room for each 35 licensed beds, or major fraction thereof. At least one airborne infection isolation room shall be provided. Airborne infection isolation rooms shall be labeled with the words "Airborne Infection Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom.

#### **Exceptions:**

1. Acute psychiatric hospitals shall provide airborne infection isolation rooms at the ratio of one room for each 50 beds, or major fraction thereof.
2. Airborne infection isolation rooms are not required for chemical dependency recovery services.

**1224.14.3.2 Anteroom doors.** Airborne infection isolation room(s) shall have self-closing and latching devices on all anteroom doors.

**1224.14.3.3 Anteroom.** A separate anteroom shall be provided between the airborne infection isolation room and the corridor, which shall constitute the primary entrance to the airborne infection isolation room. This anteroom shall have a handwashing fixture, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the isolation room and means to allow for airflow from the anteroom into the airborne infection isolation room. Doors shall be aligned to allow large equipment to be wheeled into the airborne infection isolation room unless a secondary door complying with Section 1224.14.3.2 is provided. One anteroom may serve no more than two airborne infection isolation rooms.

**1224.14.3.4 Secondary entry.** When a secondary entry is provided, the secondary doors shall be provided with locking devices which are readily operable from the room side and which are readily operable by the facil-

ity staff on the other side. When key locks are used on isolation rooms, keys shall be located at the nurses' station in a prominent readily accessible location.

**1224.14.3.5 Sealed-tight room.** Airborne infection isolation room perimeter walls, ceilings, floors, doors, and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

**1224.14.3.6 Adjoining toilet room.** Each isolation room shall have its own adjoining toilet room with an emergency nurse call system, a lavatory, a shower providing a seat or a space for a shower chair and a toilet equipped with a bedpan flushing attachment with a vacuum breaker.

**1224.14.4 Protective environment room(s).**

**1224.14.4.1 General.** Protective environment rooms for the protection of certain immunosuppressed patients may be provided by the facility. Protective environment rooms shall be labeled "Protective Environment Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom. Protective environment rooms shall contain only one bed.

**1224.14.4.2 Anteroom doors.** Protective environment room (s) shall have self-closing and latching devices on all anteroom doors.

**1224.14.4.3 Anteroom.** A separate anteroom shall be provided between the protective environment room and the corridor, hallway or adjoining space which shall constitute the only entrance to the protective environment room. This anteroom shall have a handwashing fixture, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the protective environment room. There shall be means to allow for airflow from the protective environment room into the anteroom. Anteroom doors shall be aligned so that large equipment can be wheeled into the protective environment room. One anteroom may serve no more than one protective environment room.

**Exception:** Alternate designs for protective environment rooms, without individual anterooms, may be approved by the enforcement agency when it can be demonstrated that the alternate design meets the requirements of the California Mechanical Code and does not compromise or alter any health or fire protection component, assembly or system.

**1224.14.4.4 Adjoining toilet room.** Room shall meet the requirements of Section 1224.14.3.6.

**1224.14.4.5 Sealed-tight room.** Protective environment room perimeter walls, ceiling, floors, doors, and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

**1224.14.5 Seclusion room(s).** If provided, the hospital shall provide one or more single bedrooms for patients needing close supervision for medical and/or psychiatric care. This may be part of the psychiatric unit described in Section 1224.31. If the single bedroom(s)

is part of the acute-care nursing unit, the provisions of Section 1224.14.1 shall apply, with the following exceptions: each room shall be for single occupancy; each shall be located to permit staff observation of the entrance, preferably adjacent to the nurses' station; and each shall be designed to minimize the potential for escape, hiding, injury or suicide. If vision panels are used for observation of patients, the arrangement shall insure patient privacy and prevent casual observation by visitors and other patients.

**1224.15 Surgical service space.** A minimum of one operating room and one recovery bed is required. The surgical service space shall be located and arranged to prevent nonrelated traffic through the service space.

An operating room suite design with a sterile core shall provide for no cross traffic of staff and supplies from the decontaminated/soiled areas to the sterile/clean areas. The use of facilities outside the operating room for soiled/decontaminated processing and clean assembly and sterile processing shall be designed to move the flow of goods and personnel from dirty to clean/sterile without compromising universal precautions or aseptic techniques in both departments.

**Exception:** Surgical service space is not required in a rural general acute care hospital, if the hospital maintains written transfer agreements with one or more general acute care hospitals that provide surgical and anesthesia services. Written transfer agreements shall be approved by the Department of Public Health, Licensing and Certification.

**1224.15.1 Surgery.**

**1224.15.1.1 General operating room(s).** In new construction, each room shall have a minimum clear floor area of 400 square feet (37.16 m<sup>2</sup>) with a minimum of 20 feet (6096 mm) clear dimension between fixed cabinets and built-in shelves; and a system for emergency communication with the surgical service space control station. X-ray or imaging viewing capabilities shall be provided.

**Exception:**

1. Where renovation of existing operating rooms is undertaken in facilities built under the 2001 or prior California Building Code, each operating room shall have a minimum clear floor area of 324 square feet (30.10 m<sup>2</sup>) with a minimum of 18 feet (5486 mm) clear dimension between fixed cabinets and built-in shelves.
2. For shelled floor spaces built under the 2001 or prior California Building Code, each existing operating room shall have a minimum clear floor area of 324 square feet (30.10 m<sup>2</sup>) with a minimum of 18 feet (5486 mm) clear dimension between fixed cabinets and built-in shelves.

**1224.15.1.2 Surgical cystoscopic and other endo-urologic procedures.** In new construction each room shall have a minimum clear floor area of 250 square feet

(23.23 m<sup>2</sup>) with a minimum of 15 feet (4572 mm) clear dimension between fixed cabinets and built-in shelves. X-ray viewing capability shall be provided.

**Exception:**

1. Where renovation of operating rooms is undertaken in facilities built under the 2001 or prior California Building Code rooms for surgical cystoscopy shall have a minimum clear floor area of 180 square feet (16.72 m<sup>2</sup>). Cast rooms for open reductions, if provided, shall have a minimum clear floor area of 180 square feet (16.72 m<sup>2</sup>), no dimension of which shall be less than 11 feet (3353 mm).
2. For shelled spaces built under the 2001 or prior California Building Code, each surgical cystoscopy shall have a minimum clear floor area of 180 square feet (16.72 m<sup>2</sup>). Cast rooms for open reductions, if provided, shall have a minimum floor area of 180 square feet (16.72 m<sup>2</sup>), no dimension of which shall be less than 11 feet (3353 mm).

**1224.15.2 Preoperative patient holding area(s).** In facilities with two or more operating rooms, area(s) shall be provided to accommodate gurney patients or sitting space for ambulatory patients not requiring gurneys. These area(s) shall be under the direct visual control of the nursing staff and may be part of the recovery service space. Each gurney station shall be a minimum clear floor area of 80 square feet (7.43 m<sup>2</sup>) and shall have a minimum clearance of 3 feet (914 mm) on the sides of the gurneys and the foot of the gurney. Provisions for patient privacy such as cubicle curtains shall be made.

**1224.15.3 Service areas.** Services, except for the enclosed soiled workroom referenced in Section 1224.15.3.7 and the housekeeping room referenced in Section 1224.15.3.12. Housekeeping room may be shared with the obstetrical facilities. Service areas, when shared with delivery rooms, shall be designed to avoid the passing of patients or staff between the operating room and the delivery room areas.

**1224.15.3.1 Control station.** Control stations shall be located to permit visual observation of all traffic into the surgical service space.

**1224.15.3.2 Supervisor's office or station.**

**1224.15.3.3 Sub-sterile areas.** If provided, a sub-sterile area(s) shall be equipped with a flash sterilizer, warming cabinet, and handwashing fixture. If a sterilizing facility(ies) with high-speed sterilizer(s) or other sterilizing equipment for immediate or emergency use are provided, they shall be grouped to service several operating rooms for convenient, efficient use; and a work space and handwashing fixture shall be included. Other facilities for processing and sterilizing reusable instruments, etc., may be located in another hospital department such as central services.

**1224.15.3.4 Medication station.** Shall be provided in accordance with Section 1224.14.2.8.

**1224.15.3.5 Scrub facilities.** Scrub sinks shall be located outside of sterile areas. A minimum of two

scrub sinks shall be provided in a surgical unit containing one operating room. Four scrub sinks shall be provided in surgical units containing two operating rooms. One additional scrub sink shall be provided for each additional operating room. Scrub sinks shall have water supply controls not requiring direct contact of the hands for operation.

**1224.15.3.6 Clock.** A direct-wired or battery-operated clock or other equivalent timing device shall be visible from the scrub-up sinks.

**1224.15.3.7 Soiled workroom.** An enclosed soiled workroom (or soiled holding room that is part of a system for the collection and disposal of soiled material) for the exclusive use of the surgical service space shall be provided. The soiled workroom shall contain a flushing-rim clinical sink or equivalent flushing-rim fixture, a handwashing fixture, a work counter, and space for waste receptacles and soiled linen receptacles. Rooms used only for temporary holding of soiled material may omit the flushing-rim clinical sink and work counters. However, if the flushing-rim clinical sink is omitted, other provisions for disposal of liquid waste shall be provided. The room shall not have direct connection with operating rooms. Soiled and clean utility room or holding rooms shall be separated. The soiled workroom shall provide 24 square feet (2.23 m<sup>2</sup>) per operating room up to eight operating rooms and shall have a minimum area of 48 square feet (4.46 m<sup>2</sup>), with no dimension less than 6 feet (1829 mm).

**1224.15.3.8 Clean utility room.** This room shall not be used for food preparation.

A clean utility room is required when clean materials are assembled within the surgical service space prior to use or following the decontamination cycle. It shall contain a work counter, a handwashing fixture, storage facilities for clean supplies, and a space to package reusable items. The storage for sterile supplies must be separated from this space. If the room is used only for storage and holding as part of a system for distribution of clean supply materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility rooms or holding rooms shall be separated.

**1224.15.3.9 Anesthesia workroom.** Provide an anesthesia workroom for cleaning, testing and storing anesthesia equipment. This room shall contain work counter(s) and sink(s) and racks for cylinders.

**1224.15.3.10 Equipment storage room(s)** for equipment and supplies used in surgical service space. Each surgical service space shall provide sufficient storage area to keep its required corridor width free of equipment and supplies, but not less than 150 square feet (13.94 m<sup>2</sup>) or 50 square feet (4.65 m<sup>2</sup>) per operating room, whichever is greater.

**1224.15.3.11 Staff clothing change areas.** Appropriate areas shall be provided for male and female personnel (orderlies, technicians, nurses and doctors) working within the surgical service space. The areas shall contain lockers, showers, toilets, lavatories equipped for handwashing, and space for donning surgical attire.

These areas shall be arranged to encourage a one-way traffic pattern so that personnel entering from outside the surgical service space can change and move directly into the surgical service space.

**1224.15.3.12 Housekeeping room.** Shall be provided for the exclusive use of the surgical service space. It shall be directly accessible from the service space.

#### 1224.16 ANESTHESIA SERVICE SPACE.

**1224.16.1 Post-anesthetic care units (PACUs).** Each PACU shall contain a medication station in accordance with Section 1224.14.2.8; handwashing fixtures; nurse control with charting facilities; clinical sink, refrigerator, provisions for bedpan cleaning; and storage space for gurneys, supplies, and equipment. Additionally, the design shall provide a minimum of 80 square feet (7.43 m<sup>2</sup>) for each patient position with a clearance of at least 5 feet (1524 mm) between patient gurneys and a minimum of 4 feet (1218 mm) between the sides and the foot of patient gurneys and adjacent walls or any other fixed obstructions. Provisions for patient privacy such as cubicle curtains shall be made. In new construction, at least one door to the recovery room shall access directly from the surgical service space without crossing public corridors. Handwashing fixtures shall be provided with at least one for every four gurneys uniformly distributed to provide equal access from each patient gurney.

**Exception:** In a rural general acute care hospital, when the surgical service space is not provided, the anesthesia service space is not required. The hospital must maintain written transfer agreements with one or more general acute care hospitals that provide surgical and anesthesia services. Written transfer agreements shall be approved by the Department of Public Health, Licensing and Certification.

#### 1224.17 CLINICAL LABORATORY SERVICE SPACE.

**1224.17.1 General requirements.** All hospitals shall provide space and equipment to perform urinalysis, complete blood counts, hemoglobin blood typing and cross matching. If laboratory facilities for bacteriological, serological, pathological and additional hematological procedures are not available in the community, then space, equipment and supplies for such procedures shall be provided. The following physical facilities shall be provided:

1. Laboratory work space.
2. Refrigerated blood storage facilities for transfusions shall be provided. Blood storage refrigerator shall be equipped with temperature-monitoring and alarm signals that are monitored continuously.
3. Handwashing fixture.

#### 1224.18 RADIOLOGICAL/IMAGING SERVICE SPACE.

**1224.18.1 Minimum requirements.** Hospital shall provide a minimum of:

1. One fluoroscopy room, which can also provide x-ray examination services.
2. Space for processing images.

3. A toilet room adjoining each fluoroscopy room, in addition to other toilet room facilities located adjacent to or in the immediate vicinity.
4. An office or other suitable area for viewing and reporting radiographic examination.
5. Storage spaces for all image equipment, supplies and copies of reports.
6. Handwashing fixtures located within the unit.
7. Dressing room facilities.

**1224.18.1.1 Radiation protection.** A certified physicist or other qualified expert shall specify the type, location, and amount of radiation protection to be installed in accordance with the final approved department layout and equipment selections. Where protected alcoves with view windows are required, a minimum of 1'-6" (0.45 meter) between the view window and the outside partition edge shall be provided. Radiation protection requirements shall be incorporated into the construction documents and comply with Chapter 31C and the requirements of California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, and Subchapter 4.

**1224.18.2 Angiography.** If provided, angiography space shall accommodate the following:

1. A control room with a view window to permit full view of the patient.
2. A scrub sink located outside the staff entry to the procedure room.
3. Patient holding area shall accommodate at least one patient gurney with a minimum of 3-foot (1524 mm) clearance on the long side.
4. Storage for portable equipment and catheters shall be provided.

**1224.18.2.1 Surgery.** If surgery is to be performed in the angiography room, the room must comply with general operating room requirements in Section 1224.15.1.1.

**1224.18.3 Computerized tomography (CT) scanning.** If provided, CT space shall accommodate the following:

**1224.18.3.1 Spaces required.** If provided, CT scan spaces shall accommodate the equipment with a minimum of 3 feet (1524 mm) on all sides of the equipment, together with the following:

1. A control room shall be provided that is designed to accommodate the computer and other controls for the equipment. A view window shall be provided to permit view of the patient.
2. A patient toilet room convenient to the procedure room.

**1224.18.4 Magnetic resonance imaging (MRI).** If provided, the MRI room shall accommodate the equipment with a minimum of 3 feet (1524 mm) on all sides of the equipment, together with the following:

1. A control room shall be provided with full view of the patient in the MRI scanner. The control console shall



be positioned so the operator has a full view of the approach and entrance to the MRI scanner room.

2. An anteroom or area visible from the control room shall be located outside the MRI scanner room so that patients, health care personnel, and other employees must pass through it before entering the scanning area and control room. The room or area shall be outside the restricted areas of the MRI's magnetic field.
3. A computer room shall be provided.

**1224.18.4.1 Hand-washing station.** Hand-washing station(s) shall be provided convenient to the MRI scanner room, but need not be within the room.

**1224.18.4.2 Wall, floor, and ceiling assemblies.** Wall, floor, and ceiling assemblies shall accommodate the installation of required radio frequency (RF)-shielded assemblies. All doors, windows, and penetrations into the RF-shielded enclosure shall be RF-shielded. As well as RF shielding, individual sites may also require magnetic shielding on some or all surfaces to contain portions of the magnetic field not contained by the RF shield.

**1224.18.4.3 Lighted sign.** MRI rooms shall be clearly marked with a red light and lighted sign stating, "The Magnet Is On". This light and sign are to be lighted at all times and have a backup energy source to remain illuminated for at least 24 hours in the event of a loss of power.

**1224.18.4.4 Magnetic field strength identification.** Facilities shall use finishes or markings to identify the critical values of the magnetic field surrounding the MRI scanner, including the 5-gauss exclusion zone or other magnetic field strength values that may impair the operation of equipment.

**1224.18.4.5 Special ventilation requirements.** Where superconducting MRI scanners are installed, an insulated cryogen quench exhaust pipe as well as room exhaust and pressure equalization shall be provided to protect occupants in the event of a cryogen breach.

**1224.18.5 Ultrasound.** When provided, the ultrasound room shall comply with the following:

**1224.18.5.1 Space requirements.**

1. Area. Rooms used for ultrasound examination/treatment shall have a minimum clear floor area of 120 square feet (11.15 m<sup>2</sup>).
2. Clearances. A minimum clear dimension of 3 feet (914 mm) shall be provided on three sides of the table/stretchers.

**1224.18.5.2 Handwashing fixture.** A handwashing fixture shall be provided within the procedure room.

**1224.18.5.3 Patient toilet(s).** A patient toilet shall be directly accessible to the procedure room. The patient toilet may be permitted to serve more than one procedure room.

**1224.18.6 Mammography.** When provided, the mammography room shall comply with the following:

**1224.18.6.1 Space requirements.**

1. Area. Mammography rooms shall be a minimum of 100 square feet (9.3 m<sup>2</sup>).
2. Shielded alcove. Each x-ray room shall include a shielded control alcove. For mammography machines with built-in shielding for the operator, omission of the alcove shall be permitted when approved by the certified physicist.

**1224.18.6.2 Handwashing fixture.** A handwashing fixture shall be provided within the procedure room.

**1224.18.7 Support spaces.** The following spaces are common to the imaging service area and are minimum requirements unless stated otherwise:

**1224.18.7.1 Patient's toilet room(s).** In service spaces with procedure rooms that do not have dedicated patient toilets, provide a minimum of one patient toilet room within the service space.

**1224.18.7.2 Patient dressing rooms.** Dressing rooms shall be provided convenient to the imaging rooms.

**1224.18.7.3 Staff facilities.** In service space of three or more procedure rooms, staff toilet room(s) internal to the service space shall be provided.

**1224.18.7.4 Film storage (active).** If film systems are used, provide the following:

1. A room with cabinet or shelves for filing patient film for immediate retrieval shall be provided.
2. Storage facilities for unexposed film which shall include protection of film against exposure or damage.

**1224.18.7.5 Locked storage.** Provision shall be made for locked storage of medications and drugs.

**1224.19 PHARMACEUTICAL SERVICE SPACE**

**1224.19.1 Licensed pharmacy.** All hospitals having a licensed capacity of 100 or more beds shall have a pharmacy on the premises licensed by the California Board of Pharmacy.

**Note:** See General Acute Care Hospitals §70263(a), Article 3, Chapter 1, Division 5, Title 22, California Code of Regulations, for requirements concerning hospitals with fewer than 100 beds. The pharmacy room or service space shall conform to the requirements of § 1751, Article 7, Division 17, Title 16, California Code of Regulations as enforced by the California Board of Pharmacy.

**1224.19.1.1 Handwashing fixture.** Handwashing fixture(s) shall be provided within each separate room where open medication is handled, or in an anteroom, or immediately outside the room where open medication is handled, still within the pharmaceutical service space.

**Exception:** ISO Class 5 sterile preparation areas (e.g., chemotherapy and intravenous solutions) and

their ISO Class 7 buffer area(s) shall not contain sources of water (sinks) or floor drains. However the anteroom to the buffer area shall have a hand-washing fixture regardless of its intended ISO Classification (i.e. Class 7 or Class 8). Reference: U.S. Pharmacopeia (USP) 797 Pharmaceutical Compounding – Sterile Preparations.

**1224.19.1.2 Location.** Provide for convenient access to toilet room and locker.

#### 1224.20 DIETETIC SERVICE SPACE

**1224.20.1 General.** Food service facilities and equipment shall conform to these standards, the standards of the National Sanitation Foundation and the requirements of the local public health agency.

**1224.20.2 Functional elements.** On-site conventional food service preparation shall be provided as follows in the size and number appropriate for the type of food service selected:

**1224.20.2.1 Location.** Patient food preparation areas shall be directly accessible to the entry for food supply deliveries and for the removal of kitchen wastes, interior transportation, storage, etc., without traversing patient or public circulation. Food preparation, service and storage shall be inaccessible to nondietetic service staff.

**1224.20.2.2 Receiving/control stations.** Provide an area for the receiving and control of incoming dietary supplies.

##### 1224.20.2.3 Storage.

1. Food storage space shall be convenient to the receiving area and shall be located to exclude traffic through the food preparation area to reach them. Storage spaces for bulk, refrigerated, and frozen foods shall be provided. At least one week's (7 days) supply of staple foods and at least two (2) days' supply of frozen, and two (2) days' supply of perishable foods shall be maintained on the premises. Food storage components shall be grouped for convenient access from receiving and to the food preparation areas. All food shall be stored clear of the floor. Lowest shelf shall be not less than 12 inches (305 mm) above the floor or shall be closed in and sealed tight for ease of cleaning.

As a minimum, dietary storage space shall be provided in accordance with the following schedule:

Licensed Bed Capacity	Storage Space
1 to 99 beds	2 square feet (0.19 m <sup>2</sup> ) per bed
100 to 199 beds	200 square feet (18.58 m <sup>2</sup> ) plus 1 square foot (0.0929 m <sup>2</sup> ) per bed in excess of 100 beds

200 beds and over	300 square feet (27.99 m <sup>2</sup> ), plus 1/2 square foot (0.0465 m <sup>2</sup> ) per bed in excess of 200 beds
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Space to allow refrigeration for the storage of frozen and chilled foods shall be provided at a minimum of 2 cubic feet (0.057 m<sup>3</sup>) of usable space per bed.

2. Additional storage space for dietetic service supplies, such as paper products, equipment, tray delivery carts, etc., shall be provided.
3. Storage areas and sanitizing facilities for cans, carts and mobile-tray conveyors shall be provided.
4. Waste storage and recycling facilities (per local requirements) shall be located in a separate room easily accessible to the outside for direct pickup or disposal.

**1224.20.2.4 Cleaning supplies storage.** Provide a separate storage room for the storage of nonfood items such as cleaning supplies that might contaminate edibles.

**1224.20.2.5 Food preparation workspaces.** Provide workspaces for food preparation, cooking, and baking. These areas shall be as close as possible to the user (i.e. tray assembly and dining). Provide additional spaces for thawing and portioning.

**1224.20.2.6 Assembly and distribution.** Provide a patient tray assembly area and locate within close proximity to the food preparation and distribution areas.

**1224.20.2.7 Food service carts.** A cart distribution system shall be provided with spaces for storage, loading, distribution, receiving, and sanitizing of the food service carts. The cart traffic shall be designed to eliminate any danger of cross-circulation between outgoing food carts and incoming soiled carts, and the cleaning and sanitizing process. Cart circulation shall not be through food preparation areas.

**1224.20.2.8 Dining area.** Provide dining space(s) for ambulatory patients, staff, and visitors. These spaces shall be separate from the food preparation and distribution areas.

**1224.20.2.9 Vending services.** If vending devices are used for unscheduled meals, provide a separate room that can be accessed without having to enter the main dining area.

**1224.20.2.10 Ware-washing facilities.** Ware-washing space shall be provided in a room separate from food preparation and serving areas. It shall be designed to prevent contamination of clean wares with soiled wares through cross-traffic. The clean wares shall be transferred for storage or use in the dining room area without having to pass through food preparation areas.

1. Commercial-type ware-washing equipment shall be provided.

2. Space shall be provided for receiving, scraping, sorting and stacking soiled tableware separate from food preparation areas.
3. Convenient handwashing stations shall be provided in the ware-washing space.

**1224.20.2.11 Pot washing facilities.** Pot washing shall include multi-compartmented sinks.

**1224.20.2.12 Waste storage room.** A food waste storage room shall be conveniently located to the food preparation and ware washing areas but not within the food preparation area. It shall have direct access to the hospital's waste collection and disposal facilities.

**1224.20.2.13 Handwashing fixtures.** Handwashing fixtures shall be located conveniently accessible at locations throughout the unit.

**1224.20.2.14 Office space.** Office or other space shall be provided for the dietitian or dietetic service supervisor.

**1224.20.2.15 Toilet room(s) and locker spaces.** Toilet rooms shall be provided for the exclusive use of the dietary staff. They shall not open directly into the food preparation areas, but shall be in close proximity to them. An enclosed, separate locker area shall be provided for dietetic service employee's clothing and personal belongings.

**1224.20.2.16 Housekeeping room.** A housekeeping room, meeting the requirements of Section 1224.4.15, shall be provided within the dietary department for the exclusive use of the dietary department.

**1224.20.3 Outside service.** On approval of the Licensing Agency, when food is provided by an outside food service, all applicable licensing and certification requirements shall be met. The facility shall maintain adequate space, equipment and food supplies to accommodate required functional elements listed in Section 1224.20.2, as required to provide patient food service in the event that outside food service is interrupted.

## SUPPORT SERVICES

### 1224.21 ADMINISTRATIVE SPACE.

**1224.21.1 Administration.** An administration area shall be provided which shall provide for the following functions:

1. A lobby with reception and information counter or desk, waiting space, men's and women's public toilet room facilities, telephones and drinking fountain.
2. Offices for administrator and admitting.

**1224.21.2 Records.** Hospitals shall provide a health record service which shall accommodate the following functions:

1. Work area for sorting and recording records for either paper or electronic media.

2. Storage area for records for either paper or electronic media.

### 1224.22 CENTRAL STERILE SUPPLY.

**1224.22.1 Minimum requirements.** A central supply and sterilizing area shall be provided. Rooms and spaces shall accommodate the following services and equipment:

1. **Soiled work area.** A receiving and gross cleaning area which shall contain work space and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled material.
2. **Clean work area.** A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. **Sterilizing space.**
4. **Storage.** Provide storage space for sterile supplies and unsterile supplies.

**Exception:** Section 1224.22.1 does not apply to hospitals which serve psychiatric or alcoholism patients exclusively.

**1224.22.2** All sterilizers and autoclaves which emit steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

**Exception:** Small instrument sterilizers.

### 1224.23 STORAGE.

**1224.23.1 General storage.** Hospitals shall provide general storage space of at least 20 square feet (1.86 m<sup>2</sup>) per bed in addition to specialized storage spaces. All storage spaces shall be readily accessible on the site of the facility.

**1224.23.2 Specialized storage.** Specialized storage spaces shall include the following:

**1224.23.2.1 Linen.** Provide separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m<sup>2</sup>) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m<sup>2</sup>), except where linen chutes are provided, and may be within the soiled utility room.

**1224.23.2.2 Supply.** One supply storage space having a minimum area of 15 square feet (1.39 m<sup>2</sup>) shall be provided in each nursing unit. Supply storage may be within the clean utility room used only as part of a system for distributing clean and sterile supplies.

**1224.23.2.3 Wheelchairs.** A room or space shall be provided in each nursing unit for wheelchairs and gurneys. The wheelchair and gurney space shall have a minimum area of 15 square feet (1.39 m<sup>2</sup>).

**1224.23.2.4** Sterile and unsterile supplies shall be stored separately.

**1224.23.2.5** Food storage shall be as described in Section 1224.20.

#### 1224.24 MORGUE AND AUTOPSY FACILITIES.

**1224.24.1** General acute-care hospitals with a licensed bed capacity of 50 or more beds shall provide a morgue with autopsy facilities.

**Exception:** This may not be required if it can be demonstrated to the licensing agency that morgue and autopsy facilities are available locally.

**1224.24.2 Minimum requirements.** The morgue and autopsy space shall have a minimum of 250 square feet (23.23 m<sup>2</sup> of floor area, no dimension of which shall be less than 10 feet (3048 mm), and provide for:

1. Handwashing fixture.
2. Space for refrigerated compartments if human remains are held unembalmed. Refrigerated rooms and prefabricated body refrigerator temperatures shall not be higher than 45°F (25°C).

#### 1224.25 EMPLOYEE DRESSING ROOMS AND LOCKERS.

**1224.25.1 Minimum facilities.** Hospitals shall provide the following:

1. Separate dressing rooms for male and female personnel with lockers, lavatory and toilet.
2. Additional dressing rooms for the surgical service and as required within any of the supplemental services.

**1224.26 HOUSEKEEPING ROOMS.** Shall be provided to serve each department and nursing unit, and may be shared by compatible departments, except when specifically required by other sections.

#### 1224.27 LAUNDRY.

**1224.27.1** If a laundry is to be provided, the following is required in addition to the laundry room:

1. A separate soiled linen receiving, holding and sorting room with handwashing fixture.
2. A separate clean linen storage, issuing and holding room.
3. Storage for laundry supplies.

**1224.27.2 Outside service.** If linen is processed off site, the following shall be provided within the hospital:

1. Soiled linen holding room.
2. Clean linen receiving room.
3. Clean linen storage room.

#### SUPPLEMENTAL SERVICES

##### 1224.28 SUPPLEMENTAL SURGERY SERVICES.

**1224.28.1 Cardiovascular and other special procedures.** When provided, the cardiovascular room shall have a minimum clear floor area of 650 square feet (60.39 m<sup>2</sup>), with a minimum of 20 feet (6096 mm) clear dimension. Orthopedic surgical and other special procedure rooms shall have a minimum clear floor area of 600 square feet (55.74 m<sup>2</sup>), with a minimum of 20 feet (6096 mm) clear dimension. When open-heart surgery is performed, an additional room in the restricted area of the surgical service space, preferably adjoining this operating room, shall be designated as a pump room where extra corporeal pump(s), supplies and accessories are stored and serviced. Appropriate plumbing and electrical connections shall be provided in the cardiovascular, pump, and storage rooms.

**1224.28.1.1 Service areas.** Shall be provided in accordance with Section 1224.15.3.

##### Exceptions:

1. Where renovation work is undertaken in facilities built under the 2001 or prior California Building Code, existing rooms for cardiovascular, and other special procedures may have a minimum clear floor area of 500 square feet (46.45 m<sup>2</sup>). Orthopedic surgical rooms shall have a minimum clear floor area of 360 square feet (33.44 m<sup>2</sup>) and a minimum dimension of 18 feet (5486 mm).
2. For shelled spaces built under the 2001 or prior California Building Code Rooms for cardiovascular, and other special procedures may have a minimum clear floor area of 500 square feet (46.45 m<sup>2</sup>). Orthopedic surgical rooms shall have a minimum clear floor area of 360 square feet (33.44 m<sup>2</sup>) and a minimum dimension of 18 feet (5486 mm).

##### 1224.28.2 Cardiac catheterization.

**1224.28.2.1 Procedure room.** A procedure room with a minimum clear floor area of 400 square feet (37.16 m<sup>2</sup>) for the procedure room in addition to spaces for control, monitoring and recording equipment, and x-ray power and controls, and a minimum of one scrub sink for each catheterization laboratory. This space does not include the control room.

**1224.28.2.2 Control room.** A control room or area shall be provided. A view window permitting full view of the patient from the control console shall be provided.

**1224.28.2.3 Equipment space.** An equipment space or enclosure large enough to contain x-ray transformers, power modules, and associated electronics and electrical gear shall be provided.

**1224.28.2.4 Scrub facilities.** Scrub facilities with hands-free operable controls shall be provided adjacent to the entrance of procedure rooms.

**1224.28.2.5 Staff clothing change areas.** Appropriate areas shall be provided for male and female staff working within the surgical service space. The areas shall contain lockers, showers, toilets, lavatories equipped for handwashing, and space for donning surgical attire. These areas shall be arranged to ensure a traffic pattern so that personnel entering from outside the service space can enter, change their clothing, and move directly into the cardiac catheterization service space. The staff change area may be combined with the surgical staff change area.

**1224.28.2.6 Patient holding.** A patient preparation, holding, and recovery area or room shall be provided and arranged to provide visual observation before and after the procedure. This may occur in a unit outside of the catheterization service space.

**1224.28.2.7 Clean utility room.** A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain a work counter and handwashing fixture. If the room is used only for storage and holding of clean and sterile supply materials, the work counter and handwashing fixtures shall be permitted to be omitted. The clean utility may be shared with an adjacent surgical unit.

**1224.28.2.8 Soiled utility room.** A soiled utility room shall be provided which shall contain a handwashing fixture and a clinical sink (or equivalent flushing rim fixtures). When the room is used for temporary holding or soiled materials, the clinical sink and handwashing fixture shall be permitted to be omitted. The soiled utility may be shared with an adjacent surgical unit.

**1224.28.2.9 Housekeeping room.** Shall be a minimum floor area of 15 square feet (1.4 m<sup>2</sup>). It shall contain a service sink or floor receptor and provisions for storage of supplies and housekeeping equipment. This may be shared with an adjacent surgical unit.

**1224.28.3 Freestanding cardiac catheterization laboratory service space.** A general acute care hospital referenced in Health and Safety Code Section 1255 (d)(3)(E) may provide cardiac catheterization laboratory service in a freestanding nonhospital building in conformance with this section and Section 1226.2.2. In addition, the service space shall comply with Section 1224.28.2 and applicable requirements in Section 1224.15.3 that are not covered by this section.

**1224.28.3.1 Outpatient support areas.** Outpatient support areas shall include outpatient waiting rooms in compliance with Section 1224.4.5. A separate space shall be provided where outpatients change from street clothing and are prepared for a procedure. This space shall include provisions for clothing storage, toilet room(s), sink and an area for clothing change and gowning.

**1224.28.3.2 Connection to hospital.** The freestanding cardiac catheterization laboratory service space shall be located in the nonhospital building such that the service space has a direct connection to the general acute care hospital providing cardiac surgery by a patient corridor link in compliance with Section 1224.4.7. The corridor link shall have a minimum width of 8 feet (2438 mm) as required under Section 1224.4.7.1. The corridor link shall connect to the hospital corridor system with access to all basic services as required under Section 1224.4.7.5.

**1224.28.3.3 Control station.** Control station(s) shall be located to permit visual observation of all traffic into the semi-restricted service space from unrestricted corridors and/or passageways.

**1224.28.3.4 Essential electrical system.** Cardiac catheterization laboratories shall meet the provisions for ambulatory surgical clinics required in the California Electrical Code including the requirements of Article 517.45 for an essential electrical system.

**1224.28.3.5 Services/systems and utilities.** Services/systems and utilities that support the catheterization laboratory space include, but are not limited to: normal power; emergency power; nurse call; communication and data systems; space heating systems; cooling systems; domestic hot and cold water systems; building drain and sewer systems; and medical gas systems. When these systems serve other portions of the building, any alteration to the system shall be subject to review by the Office of Statewide Health Planning and Development.

## 1224.29 INTENSIVE CARE UNITS.

**1224.29.1 General.** The following shall apply to all types of intensive care service spaces, acute respiratory-care service spaces, burn center spaces, critical-care units, coronary-care service spaces, pediatric intensive-care service spaces unless otherwise noted. Each unit shall comply with the following provisions:

**1224.29.1.1 Service space.** Each intensive-care unit shall contain not less than four or more than 12 beds.

**Exception:** When approved by the licensing agency a small or rural hospital intensive care unit may consist of less than four but not less than two patient beds.

**1224.29.1.2 Patient space.** In new construction, each patient space (whether separate rooms, cubicles, or multiple bed space) shall have a minimum of 200 square feet (18.58 m<sup>2</sup>) of clear floor area with a minimum headwall width of 13 feet (3962 mm) per bed. There shall be a minimum clear dimension of 1 foot (305 mm) clear space from the head of the bed to the wall, a minimum of 5 feet (1524 mm) clear space from the foot of the bed to the wall, a minimum of 5 feet (1524 mm) clear space on one side of each bed for patient transfer, a minimum of 4 feet (1218 mm) clear width on the non-transfer side, and a minimum of 8 feet (2438 mm) clear space between beds.

### Exceptions:

1. Where renovation of existing intensive care units is undertaken, in facilities approved under the 2001 or prior California Building Code, existing patient space (whether separate rooms, cubicles, or multiple bed space) may be renovated or replaced in kind one for one in the renovated space. Such patient space shall have no less than 132 square feet (12.26 m<sup>2</sup>) with no dimension less than 11 feet (3353 mm), and with 4 feet (1219 mm) of clearance at each side and the foot of the bed, and with a minimum of 8 feet (2438 mm) between beds. The space shall be designed so that all beds shall be placed in relation to the nurse's sta-

tion or work area to permit, enable or allow maximum observance of patients.

2. For shelled space approved under the 2001 or prior California Building Code as an intensive-care unit, patient space (whether separate rooms, cubicles, or multiple bed space) may be renovated or replaced in kind one for one in the renovated space. Such patient space shall have separate rooms or cubicles for single patient use no less than 132 square feet (12.26 m<sup>2</sup>) with no dimension less than 11 feet (3353 mm) and with 4 feet (1219 mm) of clearance at each side and the foot of the bed, and with a minimum of 8 feet (2428 mm) between beds. The space shall be designed so that all beds shall be placed in relation to the nurses' station or work area to permit, enable or allow maximum observation of patients.

**1224.29.1.3 Private rooms.** When private rooms or cubicles are provided, view panels to the corridor shall be required with a means to provide visual privacy. Where only one door is provided to a bed space, it shall be at least 4 feet (1219 mm) wide and arranged to minimize interference with movement of beds and large equipment. Sliding doors shall not have floor tracks. Where sliding doors are used for access to cubicles within a service space, a 3-foot-wide (914 mm) swinging door may also be provided for personnel communication.

**1224.29.1.4 Modular toilet.** Modular toilet/sink combination units located within a privacy curtain may be used within each patient space or private room. The toilet fixture shall be completely contained within cabinetry when not in use. This fixture shall not be equipped with a bedpan washing attachment. Exhaust ventilation requirements shall comply with the California Mechanical Code.

**1224.29.1.5 Visitors and visual privacy.** Each patient bed area shall have space at each bedside for visitors, and provisions for visual privacy from casual observation by other patients and visitors. For both adult and pediatric units, there shall be a minimum of 8 feet (2438 mm) between beds.

**1224.29.1.6 Outside environment.** Each patient bed shall have visual access, other than clerestory windows and skylights, to the outside environment with not less than one outside window in each patient bed area.

**1224.29.1.6.1 Distance.** The distance from the patient bed to the outside window shall not exceed 50 feet (15 240 mm). When partitioned cubicles are used, patients' view to outside windows may be through no more than two separate clear vision panels.

**1224.29.1.7 Handwashing fixtures.** Handwashing fixtures shall be convenient to nurse stations and patient bed areas. There shall be at least one handwashing fixture for every three beds in open plan areas, and one in each patient room. The handwashing fixture shall be

located near the entrance to the patient cubicle or room.

**1224.29.1.8 Administrative center or nurse station.** This area shall have space for counters and storage. It may be combined with or include centers for reception and communication.

**1224.29.1.9 Nurses' work area.** There shall be direct visual observation between either a centralized or distributed nurse station or work station and the heads of all patient beds in the intensive care unit.

**1224.29.1.10 Monitoring.** Each unit shall contain equipment for continuous monitoring. Monitors shall be located to permit easy viewing but not interfere with access to the patient.

**1224.29.1.11 Emergency equipment storage.** Space that is easily accessible to the staff shall be provided for emergency equipment such as a CPR cart.

**1224.29.1.12 Medication station.** Shall be provided in accordance with Section 1224.14.2.8.

**1224.29.1.13 Airborne infection isolation room.** At least one airborne infection isolation room shall be provided per unit. The room shall comply with the requirements of Section 1224.14.3; however, the adjoining toilet room is not required. Modular toilet/sink combination units located within a privacy curtain may be used. The toilet fixture shall be completely contained within cabinetry when not in use. Exhaust ventilation requirements shall comply with the California Mechanical Code.

**Exception:** When approved by the licensing agency an airborne infection isolation room is not required for small or rural hospitals.

**1224.29.1.14 Additional service spaces.** The following additional service spaces shall be immediately available within each intensive care service space. These may be shared by more than one intensive care unit provided that direct access is available from each.

**1224.29.1.14.1 Clean utility room.** If the room is used for preparing patient care items, it shall contain a work counter, a handwashing fixture, and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as part of a system for distribution of clean and sterile supply materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

**1224.29.1.14.2 Clean linen storage.** There shall be a designated area for clean linen storage. This may be within the clean utility room or a separate closet.

**1224.29.1.14.3 Soiled utility room.** Size shall be a minimum 50 square feet (4.65 m<sup>2</sup>); if shared between units, it shall be a minimum of 75 square feet (6.97 m<sup>2</sup>). The soiled workroom shall contain a clinical sink (or equivalent flushing-rim fixture). The room shall contain a handwashing fixture. The

above fixtures shall both have a hot and cold mixing faucet. The room shall have a work counter and space for separate covered containers for soiled linen and a variety of waste types. Rooms used only for temporary holding of soiled material may omit the clinical sink and work counter. If the flushing-rim clinical sink is eliminated, facilities for cleaning bedpans shall be provided elsewhere.

**1224.29.1.14.4 Nourishment area.** There shall be a nourishment area with sink, work counter, refrigerator, storage cabinets, and equipment for hot and cold nourishments between scheduled meals. The nourishment station shall include space for trays and dishes used for nonscheduled meal service. Provisions and space shall be included for separate temporary storage of unused and soiled dietary trays not picked up at mealtime. Handwashing fixtures shall be in or immediately accessible from the nourishment area.

**1224.29.1.14.5 Ice machine.** There shall be available equipment to provide ice for treatments and nourishment. Ice-making equipment may be in the clean utility room or at the nourishment station. Ice intended for human consumption shall be from self-dispensing icemakers.

**1224.29.1.14.6 Equipment storage room.** Appropriate room(s) shall be provided for storage of large items of equipment necessary for patient care. Each intensive care unit shall provide not less than 20 square feet (1.86 m<sup>2</sup>) per patient bed.

**1224.29.1.15 Support.** The following shall be provided and shall be located immediately adjacent to the unit:

1. **Visitors' waiting room.**
2. **Office space.**
3. **Staff lounge(s) and toilet room(s).**
4. **Multipurpose room(s).** Provide for staff, patients, and patients' families for patient conferences, reports, education, training sessions, and consultation.
5. **Housekeeping room.** Provide within or immediately adjacent to the intensive care unit. It shall not be shared with other nursing units or departments.
6. **Gurney and wheelchair storage.** Provide a minimum 15 square feet (1.39 m<sup>2</sup>) per each nursing unit.

**1224.29.2 Newborn intensive care units (NICU).** The NICU shall comply with all the requirements of Section 1224.29.1. Additionally each NICU shall include or comply with the following:

**1224.29.2.1 Entrance.** The NICU shall have a clearly identified entrance and reception area for families. The area shall permit visual observation and contact with all traffic entering the unit.

**1224.29.2.2 Handwashing fixture(s).** Provide one handwashing fixture for each four infants or major

fraction thereof. In a multiple-bed room, every bed position shall be within 20 feet (6096 mm) of a handwashing fixture. Where an individual room concept is used, a handwashing fixture shall be provided within each infant care room.

**1224.29.2.3 Doors.** At least one door to each patient room shall be a minimum of 44 inches (1118 mm) wide.

**1224.29.2.4 View windows.** When viewing windows are provided, provision shall be made to control casual viewing of infants. Controls shall be provided to enable lighting to be adjusted over individual patient care spaces. Darkening sufficient for transillumination shall be available when necessary.

**1224.29.2.5 Control station.** A central area shall serve as a control station, shall have space for counters and storage, and shall have convenient access to handwashing fixture. It may be combined with or include centers for reception and communication and patient monitoring.

**1224.29.2.6 Area.** Each patient care space shall contain a minimum of 120 square feet (11.15 m<sup>2</sup>) of clear floor area per bassinet excluding handwashing fixtures and aisles. There shall be an aisle for circulation adjacent to each patient care space with a minimum width of 4 feet (1219 mm).

**Exceptions:**

1. Where renovation of existing NICUs is undertaken in facilities built under the 2001 or prior California Building Code, patient care areas shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per bassinet exclusive of space for nurse control, scrubbing and gowning, and reception area.
2. For shelled spaces built under the 2001 or prior California Building Code, NICUs shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per bassinet, exclusive of space for nurse control, scrubbing and gowning, and reception area.

**1224.29.2.7 Ceilings.** Ceilings shall have a noise reduction coefficient (NRC) of at least 0.90.

**1224.29.2.8 Airborne infection isolation room.** Shall comply with the requirements of Section 1224.29.1.13 except for separate toilet, bathtubs or shower. The room shall be enclosed and separated from the nursery unit with provisions for observation of the infant from adjacent nurseries or control area(s).

**1224.29.2.9 Lactation.** Space shall be provided for lactation support and consultation in or immediately adjacent to the NICU.

**1224.29.2.10 Infant formula facilities.**

**1224.29.2.10.1 Location.**

1. Where infant formula is prepared on site, direct access from the formula preparation room to any infant care room is prohibited.

2. The formula preparation room shall be located in or adjacent to the NICU. The formula preparation room may be located at another location as approved by the Licensing Agency.

**1224.29.2.10.2 Formula preparation room.** The formula preparation room shall include the following:

1. A separate cleanup area for washing and sanitizing. This area shall include a handwashing station, facilities for bottle washing and a work counter.
2. A separate room for preparing infant formula. This room shall contain a refrigerator, work counter, formula sterilizer, storage facilities and a handwashing station.

**1224.29.2.10.3 Refrigerated storage and warming facilities for infant formula.** Shall be accessible for use by NICU personnel at all times.

**1224.29.2.10.4 Commercial infant formula.** Where a commercial infant formula is used, omission of the separate cleanup and preparation rooms shall be permitted, and storage and handling in the NICU workroom or another appropriate room that is conveniently accessible at all hours shall be permitted. The preparation area shall have the following:

1. A work counter
2. A hand-washing station
3. Storage facilities

**1224.29.2.11 Emergency equipment storage.** Space shall be provided for emergency equipment that is under direct control of the nursing staff, such as a CPR cart.

**1224.29.2.12 Housekeeping room.** Shall be directly accessible from the unit and be dedicated for the exclusive use of the neonatal intensive care unit.

**1224.29.2.13 Daylight.** At least one source of daylight shall be visible from newborn care areas.

1. External windows in infant care rooms shall be glazed with insulating glass to minimize heat gain or loss.
2. External windows in infant care rooms shall be situated at least 2 feet (60.96 centimeters) away from any part of a baby's bed to minimize radiant heat loss from the baby.
3. All external windows shall be equipped with easily cleaned shading devices that are neutral color or opaque to minimize color distortion from transmitted light.

**1224.30 PEDIATRIC AND ADOLESCENT UNIT.** A pediatric nursing unit shall be provided if the hospital has eight or more licensed pediatric beds. The unit shall meet the following standards:

**1224.30.1 Patient rooms.** Each patient room shall meet the following standards:

**1224.30.1.1 Beds.** The space requirements for pediatric patient beds shall be the same as required by Section 1224.14.1.2.

**1224.30.1.2 Windows.** Each patient room shall have a window in accordance with Section 1224.4.9.

**1224.30.2 Examination or treatment rooms.** This room shall be provided for pediatric and adolescent patients. A separate area for infant examination and treatment may be provided within the pediatric nursery workroom.

**1224.30.3 Service areas.** The service areas in the pediatric and adolescent nursing units shall conform to Section 1224.14.2 and shall also provide the following:

**1224.30.3.1 Play area.** A play area shall be provided.

**1224.30.3.2 Infant formula.** Space for preparation and storage of infant formula shall be provided within the unit or other convenient location.

**1224.30.3.3 Toilet rooms.** Patient toilet room(s) with a lavatory in each room, in addition to those serving bed areas, shall be conveniently located to play area(s) and to each central bathing facility.

**1224.30.3.4 Storage.** Closets or cabinets for toys, educational, and recreational equipment shall be provided.

**1224.30.3.5 Airborne infection isolation room.** At least one airborne infection isolation room shall be provided within each pediatric unit; minimum of one per 15 beds. Airborne infection isolation room(s) shall comply with the requirements of Section 1224.14.3.

**1224.30.3.6 Clean and soiled workrooms.** Separate clean and soiled workrooms or holding rooms shall be provided as described in Sections 1224.14.2.6 and 1224.14.2.7.

## **1224.31 PSYCHIATRIC NURSING UNIT.**

**1224.31.1 Psychiatric unit space.** A psychiatric unit shall be housed in a separate and distinct nursing unit and shall provide the following:

**1224.31.1.1 General.** A psychiatric nursing unit shall meet the requirements of Section 1224.14.

**1224.31.1.2 Windows.** Windows modified to prevent patients from leaving the unit.

**1224.31.1.3 Access control.** Entrances and exits which may be locked if necessary.

**1224.31.1.4 Observation room(s).** Used for the observation of acutely disturbed patients. This room shall be designed to allow visual observation and be located near the nursing station and a bathroom.

**1224.31.1.5 Consultation room(s).** Used for interviewing patients.

**1224.31.1.6 Dining and recreation.** Provide spaces for dining and recreation. The total area for these purposes shall be not less than 30 square feet (2.8 m<sup>2</sup>) per patient.

**1224.31.1.7 Storage.** Storage closets or cabinets for recreational and occupation therapy equipment.



**1224.31.1.8 Exam or treatment room.** A room for physical examinations and medical treatment.

**1224.31.1.9 Activity spaces.** Indoor and outdoor space for therapeutic activities.

**1224.31.1.10 Occupational therapy.** Facilities for occupational therapy shall comply with Section 1224.35.3.

**1224.31.1.11 Recreation.** A recreation room with a minimum of 100 square feet (9.3 m<sup>2</sup>) in each building, and on each floor of a building accommodating six or more psychiatric patients.

**1224.31.1.12 Nurse call.** A nurses' call system is not required, but if it is included, provisions shall be made for easy removal, or for covering call button outlets.

**1224.31.1.13 Privacy.** Visual privacy in multibed rooms (e.g., cubicle curtains) is not required.

**1224.31.1.14 Tamper resistant.** The ceiling and the air distribution devices, lighting fixtures, sprinkler heads, and other appurtenances shall be of a tamper-resistant type.

**1224.31.1.15 Toilet rooms.** Each patient room shall be provided with a private toilet room that meets the following requirements:

1. The door shall not be lockable from within.
2. The door shall be capable of swinging outward.
3. The ceiling shall be of tamper-resistant construction and the air distribution devices, lighting fixtures, sprinkler heads, and other appurtenances shall be of the tamper-resistant type.

**1224.31.2 Education.** If a unit treats children of school age over a period of one month or more, it shall provide physical facilities for an educational program, such as classrooms and an office for the teacher.

**1224.31.3 Service areas.** The standards noted in Section 1224.14.2 shall apply to service areas for psychiatric nursing units.

## **1224.32 OBSTETRICAL FACILITIES (PERINATAL UNIT SPACE)**

**1224.32.1 General.** The obstetrical facility, including cesarean operating room(s) and delivery room(s), shall be located and designed to prohibit nonrelated traffic through the unit.

### **1224.32.2 Antepartum and postpartum unit**

**1224.32.2.1 Patient bedrooms.** Antepartum and postpartum bedrooms shall comply with Section 1224.14.1.

**1224.32.2.2 Service areas.** Shall be provided in accordance with Section 1224.14.2 with the following additions:

1. Staff lounge.
2. Staff storage. Lockable closets or cabinets for personal articles of staff.
3. Consultation/conference room(s).

### **1224.32.3 Cesarean/delivery service space**

**1224.32.3.1 Cesarean operating room(s).** Provide a minimum clear floor area of 360 square feet (33.45 m<sup>2</sup>) with a minimum dimension of 16 feet (4877 mm). There shall be a minimum of one such room.

**1224.32.3.2 Delivery room(s).** Provide a minimum clear floor area of 300 square feet (27.87 m<sup>2</sup>). An emergency communication system shall be connected with the obstetrical facilities control station. There shall be a minimum of one such room.

**1224.32.3.2.1 Postpartum bed ratio.** Delivery rooms, which are used for no other purpose, shall be provided at the ratio of one per 12 postpartum beds or major fraction thereof.

#### **Exceptions:**

1. If LDR or LDRP beds are provided, each LDR or LDRP may be counted as a delivery room in the postpartum bed ratio.
2. When approved by the licensing agency, the operating room of small or rural hospitals with a licensed bed capacity of 50 or less may serve as the delivery room.

#### **1224.32.3.3 Clocks.** Shall be provided as follows:

1. A direct-wired or battery-operated clock with sweep second hand and lapsed time indicators in each cesarean operating and delivery room.
2. A direct-wired or battery-operated clock or other equivalent timing device, visible from the scrub-up sinks.

**1224.32.3.4 Surgical lights.** Provide a surgical light in each cesarean operating or delivery room.

**1224.32.3.5 Infant resuscitation.** Provide within the cesarean operating rooms and delivery rooms a minimum clear floor area of 40 square feet (3.72 m<sup>2</sup>) in addition to the required area of each room or may be provided in a separate but immediately accessible room with a clear floor area of 150 square feet (13.94 m<sup>2</sup>). Six single or three duplex electrical outlets shall be provided for the infant in addition to the facilities required for the mother.

**1224.32.3.6 Labor room(s) (LDR or LDRP rooms may be substituted).** Where LDRs or LDRPs are not provided, a minimum of two labor beds shall be provided for each cesarean operating room. Each room shall be designed for either one or two beds with a minimum clear floor area of 120 square feet (11.15 m<sup>2</sup>) per bed. Each labor room shall contain a handwashing fixture and have access to a toilet room. One toilet room may serve two labor rooms. Labor rooms shall have controlled access with doors that are arranged for observation from a nursing station. At least one shower (which may be separate from the labor room if under staff control) for use of patients in labor shall be provided. Windows in labor rooms, if provided, shall be located, draped, or otherwise arranged, to preserve

patient privacy from casual observation from outside the labor room.

**Exceptions:**

1. Where renovation of labor rooms is undertaken in facilities built under the 2001 or prior California Building Code, existing labor rooms shall have a minimum clear floor area of 100 square feet (9.29 m<sup>2</sup>) per bed.
2. For shelled spaces built under the 2001 or prior California Building Code, labor rooms shall have a minimum clear floor area of 100 square feet (9.29 m<sup>2</sup>) per bed.

**1224.32.3.7 Recovery room(s) (LDR or LDRP rooms may be substituted).** Each recovery room shall contain at least two beds and have a nurse control with charting facilities located to permit visual control of all beds. Each room shall include a handwashing fixture and a medication station. A clinical sink with bedpan flushing device shall be available, as shall storage for supplies and equipment. Provide visual privacy of the new family.

**1224.32.3.8 Service areas.** Individual rooms shall be provided as indicated in the following standards; otherwise, alcoves or other open spaces that do not interfere with traffic may be used.

**1224.32.3.8.1 Services.** The following services shall be provided:

1. Control/nurse station. This shall be located to restrict unauthorized traffic into the service space.
2. Soiled workroom or soiled holding room. See Section 1224.14.2.7.
3. Fluid waste disposal.

**1224.32.3.8.2 Shared services.** The following services shall be provided and may be shared with the surgical facilities. Where shared, areas shall be arranged to avoid direct traffic between the delivery and operating rooms

**1224.32.3.8.2.1 Supervisor's office or station.** Office or station shall be a minimum of 80 square feet (7.43 m<sup>2</sup>) and have a desk.

**1224.32.3.8.2.2 Waiting room.** This room shall have toilet room(s), telephone(s) and drinking fountain(s) conveniently located. The toilet room(s) shall contain a lavatory.

**1224.32.3.8.2.3 Drug distribution station.** Shall have a handwashing fixture and provisions for controlled storage, preparation and distribution of medication.

**1224.32.3.8.2.4 Scrub facilities for cesarean operating or delivery rooms(s).** Two positions shall be provided adjacent to entrance to the first cesarean operating room. Provide one additional scrub sink per cesarean or delivery operating room. Scrub facilities shall be arranged to mini-

mize any splatter on nearby personnel or supply carts. In new construction, provide view windows at scrub stations to permit the observation of room interiors.

**1224.32.3.8.2.5 Clean utility room.** A clean utility room shall be provided if clean materials are assembled within the obstetrical service space prior to use. If a clean utility room is provided see Section 1224.14.2.6.

**1224.32.3.8.2.6 Storage.**

1. Clean sterile storage area readily available to the delivery room.
2. Equipment storage room(s) for equipment and supplies used in the obstetrical service space.

**1224.32.3.8.2.7 Workroom.** An anesthesia workroom for cleaning, testing and storing anesthesia equipment. It shall contain a work counter, sink, and provisions for separation of clean and soiled items.

**1224.32.3.8.2.8 Male and female staff clothing change areas.** The clothing change area shall be designed to encourage one-way traffic and eliminate cross-traffic between clean and contaminated personnel. The area shall contain lockers, showers, toilets, handwashing fixtures, and space for donning and disposing scrub suits and booties.

**1224.32.3.8.2.9 Staff lounge.** Lounge and toilet room facilities for obstetrical staff convenient to cesarean operating rooms(s), delivery room(s), labor rooms(s) and recovery room(s). Each toilet room shall contain handwashing fixtures.

**1224.32.3.8.2.10 On-call room.** An on-call room(s) for physician and/or staff shall be provided, but may be located elsewhere in the facility.

**1224.32.3.8.2.11 Housekeeping room.**

**1224.32.4 LDR and LDRP facilities.**

**1224.32.4.1 Location.** LDR room(s) may be located in a separate LDR service space or as part of the cesarean/delivery service space. The postpartum unit may contain LDRP rooms.

**1224.32.4.2 Space requirements.** These rooms shall have a minimum of 250 square feet (23.23 m<sup>2</sup>) of clear floor area with a minimum dimension of 13 feet (3962 mm). There shall be space for crib and sleeping space for support person. An area within the room but distinct from the mother's area shall be provided for infant stabilization and resuscitation. The medical gas outlets shall be located in the room so that they are accessible to the mother's delivery area and infant resuscitation area.

**1224.32.4.3 Occupancy.** Each LDR or LDRP room shall be for single occupancy.

**1224.32.4.4 Shower or tub.** Each LDR or LDRP room shall have direct access to a private toilet room with shower or tub.

**1224.32.4.5 Handwashing fixtures.** Each LDR or LDRP room shall be equipped with handwashing fixtures.

**1224.32.5 Newborn/well baby nurseries**

**1224.32.5.1 General.** Infants shall be housed in nurseries that comply with the standards below. All nurseries shall be adjacent to the postpartum unit and obstetrical facilities. The nurseries shall be located and arranged to preclude the need for unrelated pedestrian traffic. No nursery shall open directly onto another nursery. Each nursery shall contain the following:

**1224.32.5.1.1 Handwashing fixtures.** At least one handwashing fixture for each six infant bassinets.

**1224.32.5.1.2 Storage.** Storage for linens and infant supplies at each nursery room.

**1224.32.5.1.3 Lactation.** A consultation/demonstration/breast feeding or pump room shall be provided convenient to the nursery. Provision shall be made, either within the room or conveniently located nearby, for sink, counter, refrigeration and freezing, storage for pump and attachments, and educational materials. The area provided for the unit for these purposes, when conveniently located, may be shared.

**1224.32.5.1.4 Workroom(s).** Each nursery shall be served by a connecting workroom. The workroom shall contain gowning facilities at the entrance for staff and housekeeping personnel, work counter, refrigerator, storage for supplies, and a handwashing fixture. One workroom may serve more than one nursery room provided that required services are convenient to each. Adequate provision shall be made for storage of emergency cart(s) and equipment out of traffic and for the sanitary storage and disposal of soiled waste.

**1224.32.5.1.5 Housekeeping room.** A housekeeping room shall be provided for the exclusive use of the nursery unit. It shall be directly accessible from the unit.

**1224.32.5.1.6 Charting space.** Charting facilities shall have linear surface space to ensure that staff and physicians may chart and have simultaneous access to information and communication systems.

**1224.32.5.2 Space requirements.** Each newborn nursery room shall contain no more than 16 infant stations. Nurseries shall provide a minimum of 25 square feet (2.32 m<sup>2</sup>) of floor area per bassinet, with at least 3 feet (914 mm) between bassinets and at least 6 inches (152 mm) from a wall.

**1224.33 EMERGENCY SERVICE.**

**1224.33.1 Definition.** Levels of emergency care range from initial emergency management to definitive emergency care.

**1224.33.2 Standby emergency medical service.** If provided, initial emergency management shall include:

**1224.33.2.1 Exterior entrance.** A well-marked, illuminated and covered entrance, at grade level. The emergency vehicle entry cover shall provide shelter for both the patient and the emergency medical crew during transfer from an emergency vehicle into the building. This exterior entrance shall not be substituted for the required accessible entrance protected from the weather by canopy or roof overhang assigned for passengers loading zone. Reception, triage and control station shall be located to permit staff observation and control of access to treatment area, pedestrian and ambulance entrances, and public waiting area.

**1224.33.2.2 Treatment room.** The area shall not be less than 120 square feet (11.15 m<sup>2</sup>) of clear floor area, exclusive of toilet room(s), waiting area and storage. Each treatment room shall contain an examination light, work counter, handwashing fixtures, medical equipment, cabinets, medication storage and counter space for writing. The dimensions and arrangement of treatment rooms shall be such that there is a minimum of 3 feet (914 mm) between the sides and foot of the bed/gurney and any wall or any other fixed obstruction. The treatment room may have additional space and provisions for several patients with cubicle curtains for privacy. Multiple-bed treatment rooms shall provide a minimum of 80 square feet (7.43 m<sup>2</sup>) per patient gurney, with a minimum 8 foot width (2,438 mm) and 3 feet (914 mm) at the foot of the bed/gurney, with a minimum of 3 feet to any wall or fixed obstruction, and a minimum of 5 feet (1524 mm) between patient gurneys. Patient gurneys shall be separated from adjoining cubicles by curtains.

**Exceptions:**

1. Where renovation of existing treatment rooms is undertaken in facilities approved under the 2001 or prior California Building Code, existing treatment rooms may be renovated, or replaced in kind one for one in the renovated space. Such treatment rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area, the least dimension of which shall be 8 feet (2438 mm).
2. For shelled spaces approved under the 2001 or prior California Building Code as future emergency service space, treatment rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per bed, with a minimum dimension of 8 feet (2438 mm).

**1224.33.2.3 Storage.** Shall be sized for general medical/surgical emergency supplies, medications and equipment such as ventilator, defibrillator, splints, etc.

**1224.33.2.4 Lobby.** Provisions for reception, control, and public waiting, including a public toilet room(s) with handwashing fixture(s), and public telephone.

**1224.33.2.5 Toilet room(s).** Patient toilet room(s) with handwashing fixture(s) convenient to the treatment room(s).

**1224.33.2.6 Communication.** A communication hookup to the Poison Control Center and local EMS system.

**1224.33.2.7 Airborne infection isolation room.** Shall comply with the requirements of Section 1224.29.1.13 except for separate toilet room, bathtubs, or shower.

**1224.33.3 Basic emergency medical service.** When 24-hour emergency service is to be provided, at a minimum, the following shall be provided:

**1224.33.3.1 Exterior entrance.** Grade-level well-marked, illuminated, and covered entrance with direct access from public roads for ambulance and vehicle traffic conforming with the requirements of the local authorities having jurisdiction. Entrance and driveway shall be clearly marked. If a raised platform is used for ambulance discharge, provide a ramp for pedestrian and wheelchair access.

**1224.33.3.2 Patient access.** Paved emergency access to permit discharge of patients from automobiles and ambulances, and temporary parking convenient to the entrance.

**1224.33.3.3 Reception, triage, and control station(s).** This area shall be located to permit staff observation and control of access to treatment area, pedestrian and ambulance entrances, and public waiting area.

**1224.33.3.4 Wheelchair and gurney storage.** Shall be located with convenient access from emergency entrances.

**1224.33.3.5 Public waiting area with toilet room facilities, drinking fountains, and telephone.**

**1224.33.3.6 Examination or treatment room(s).** Shall have a minimum clear floor area of 120 square feet (11.15 m<sup>2</sup>). The room shall contain work counter(s); cabinets; handwashing fixtures; and a vision panel adjacent to and/or in the door. The dimensions and arrangement of examination and treatment rooms shall be such that there is a minimum of 3 feet (914 mm) between the sides and foot of the bed/gurney and any wall or any other fixed obstruction. When treatment cubicles are in open multi-bed areas, each cubicle shall have a minimum of 80 square feet (7.43 m<sup>2</sup>) of clear floor space with a minimum 8 foot (2438 mm) width and 3 feet (914 mm) at the foot of the bed, with a minimum of 3 feet to any wall or fixed obstruction and a minimum of 5 feet (1524 mm) between patient gurneys, and shall be separated from adjoining cubicles by curtains. Handwashing fixtures shall be provided for each four treatment cubicles or major fraction thereof in multiple-bed areas.

**Exceptions:**

1. Where renovation of existing examination or treatment room(s) is undertaken in facilities approved under the 2001 or prior California

Building Code, existing examination or treatment rooms may be renovated, or replaced in kind one for one in the renovated space. Such examination or treatment rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per examination or treatment room, the least dimension of which shall be 8 feet (2438 mm).

2. For shelled spaces approved under the 2001 or prior California Building Code as future Emergency Service space, examination or treatment room(s) shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area, the least dimension of which shall be 8 feet (2438 mm).

**1224.33.3.7 Trauma/cardiac rooms.** These rooms are for emergency procedures, including emergency surgery, and shall have at least 250 square feet (23.23 m<sup>2</sup>) of clear floor space. Each room shall have cabinets and emergency supply shelves, image viewing capability, examination lights, and counter space for writing. Additional space with cubicle curtains for privacy may be provided to accommodate more than one patient at a time in the trauma room. There shall be storage provided for immediate access to attire used for universal precautions. Doors leading from the ambulance entrance to the cardiac trauma room shall have an opening with a minimum width of 5 feet (1524 mm).

**1224.33.3.8 Orthopedic and cast work.** Provisions may be made in separate room(s) or in the trauma room. They shall include storage for splints and other orthopedic supplies, traction hooks, image viewing capability, and examination lights. If a sink is used for the disposal of plaster of paris, a plaster trap shall be provided. The clear floor space for this area shall be a minimum of 180 square feet (16.7 m<sup>2</sup>)

**1224.33.3.9 Poison Control Center and EMS communications center.** May be a part of the staff work and charting area.

**1224.33.3.10 Emergency equipment storage space.**

**1224.33.3.11 Patients' toilet room.** Where there are more than eight treatment areas, a minimum of two toilet rooms, with a lavatory in each toilet room, shall be required.

**1224.33.3.12 Storage.** Provide rooms for clean, soiled or used supplies.

**1224.33.3.12.1 Soiled workroom or soiled holding room.** See Section 1224.14.2.7. This room is for the exclusive use of the emergency service.

**1224.33.3.12.2 Clean utility room.** See Section 1224.14.2.6.

**1224.33.3.13 Administrative center or nurses' station for staff work and charting.** These areas shall have space for counters, cabinets, and medication storage, and shall have convenient access to handwashing fixtures. They may be combined with or include centers for reception and communication.

**1224.33.3.14 Staff lounge.**

**1224.33.3.15 Housekeeping room.** A housekeeping room shall be directly accessible from the unit.

**1224.33.3.16 Airborne infection isolation room.** If provided shall comply with the requirements of Section 1224.29.1.13 except for separate toilet room, bathtubs or shower.

**1224.33.3.17 Secured holding room.** If provided, shall have at least one holding/seclusion room of 120 square feet (11.15 m<sup>2</sup>). This room shall allow for security, patient and staff safety, patient observation and sound-proofing.

**1224.33.4 Other space considerations**

**1224.33.4.1 Observation units.** If provided shall have the following:

1. Handwashing fixtures shall be provided for each four treatment cubicles or major fraction thereof. Handwashing fixtures shall be convenient to nurse stations and patient bed areas.
2. Each patient bed area shall have space at each bedside for visitors and provision for visual privacy from casual observation by other patients and visitors.
3. One toilet room shall be provided for each eight treatment cubicles or major fraction thereof.
4. A sink, work counter, refrigerator, storage cabinets.

**1224.34 NUCLEAR MEDICINE**

**1224.34.1 General.** If nuclear medicine is provided, the following shall be provided:

**1224.34.1.1 Radiation protection.** A certified physicist shall specify the type, location and amount of radiation protection to be installed in accordance with final approved department layout and equipment selection. Radiation protection requirements shall be incorporated into the construction documents and comply with Chapter 31C and the requirements of California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, and Subchapter 4.

**1224.34.1.2 Nuclear medicine room.** Sized to accommodate the equipment and a gurney. Provide a handwashing fixture.

**1224.34.1.3 Radiopharmacy.** If radiopharmaceutical preparation is performed, an area adequate to house a radiopharmacy shall be provided with appropriate shielding. This area shall include adequate space for storage of radionuclides, chemicals for preparation, dose calibrators, and record keeping. If preprepared materials are used, storage and calculation area may be considerably smaller than that for on-site preparation. Space shall provide adequately for dose calibration, quality assurance, and record keeping. The area may still require shielding from other portions of the facilities.

**1224.34.2 Support areas for nuclear medicine services.** Nuclear medicine area when operated separately from the imaging department shall provide the following:

**1224.34.2.1 Entrance.** Space shall be adequate to permit entry of gurneys, beds, and able to accommodate imaging equipment, electronic consoles, and if present, computer terminals.

**1224.34.2.2 Cleanup.** Provisions for cleanup shall be located within the service space for convenient access and use. It shall include service sink or floor receptacle as well as storage space for equipment and supplies.

**1224.34.2.3 Consultation.** A consultation area may be provided.

**1224.34.2.4 Waiting.** Waiting areas shall be provided out of traffic, under staff control. If the department is routinely used for outpatients and inpatients at the same time, separate waiting areas shall be provided with screening or visual privacy between the waiting areas.

**1224.34.2.5 Dose administration area.** Provide and locate near the preparation area. Since as much as several hours may elapse for the dose to take effect, the area shall provide for visual privacy from other areas.

**1224.34.2.6 Holding.** A holding area for patients on gurneys or beds shall be provided out of traffic and under control of staff and may be combined with the dose administration area with visual privacy between the areas.

**1224.34.2.7 Patient dressing rooms.** Located convenient to the waiting area and procedure rooms. Each dressing room shall include a seat or bench, a mirror, and provisions for hanging patients' clothing and for securing valuables.

**1224.34.2.8 Patient toilet room(s).** Reserved for nuclear medicine patients and shall be located convenient to waiting and procedure rooms.

**1224.34.2.9 Staff toilet rooms(s).** Shall be located convenient to the nuclear medicine laboratory.

**1224.34.2.10 Handwashing fixtures.** Shall be located within each procedure room.

**1224.34.2.11 Control desk and reception.**

**1224.34.2.12 Storage area for clean linen.**

**1224.34.2.13 Soiled and contaminated material.** Provisions with handwashing fixtures shall be made for holding soiled material. Separate provisions shall be made for holding contaminated material.

**1224.34.3 Radiotherapy service space.**

**1224.34.3.1 Radiation therapy space.** If radiation therapy is provided, the following shall be accommodated:

1. Patient reception and waiting areas.
2. Space for medical and physics staff functions.
3. Space for equipment and supplies.
4. Housekeeping room.

5. Direct access to or space provided for radiation measurement and calibration equipment, including a calibration constancy instrument and access to a secondary standard dose meter.

- 5.1. A megavoltage treatment unit capable of delivering x-rays or gamma rays of effective energy 500 KeV or more and conforming to the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.

- 5.2. Access to a medium voltage or superficial treatment unit delivering 500 KeV or less, but otherwise having the same functional characteristics as the above mega-voltage units and conforming to the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.

- 5.3. Direct access to or space provided for brachytherapy equipment which shall meet the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.

- 5.4. Shielding of the rooms shall meet the requirements of Chapter 31C and the California Radiation Control Regulations. California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.

**1224.34.3.2 Radiation protection.** Cobalt, linear accelerators, hot lab and high dose rate brachytherapy rooms and simulation rooms require radiation protection. All rooms that provide radiation treatment shall be appropriately shielded. A certified physicist shall specify the type, location, and amount of protection to be installed in accordance with final approved department layout and equipment selection. Radiation protection requirements shall be incorporated into the construction documents and comply with Chapter 31C and the requirements of California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, and Subchapter 4.

**1224.34.3.3 Room sizes.** Rooms shall be sized as follows:

1. Cobalt rooms and linear accelerators shall be sized in accordance with equipment requirements and shall accommodate a gurney for litter borne patients. Layouts shall provide for preventing the escape of radioactive particles. Openings into the room, including doors, ductwork, vents and electrical raceways and conduits, shall be baffled to prevent direct exposure to other areas of the facility.
2. Simulator, accelerator and cobalt rooms shall be sized to accommodate the equipment with patient

access on a gurney, medical staff access to the equipment and patient, and service access.

**1224.34.3.4 General support area.** The following areas shall be provided:

1. A gurney hold area adjacent to the treatment rooms, screened for privacy, and combined with a seating area for outpatients.
2. Exam or treatment room shall be provided with a minimum of 100 square feet (9.29 m<sup>2</sup>) with a minimum dimension of 8 feet (2438 mm). Each exam room shall be equipped with a handwashing fixture.

**Exceptions:**

1. Where renovation of existing treatment rooms is undertaken in facilities built under the 2001 or prior California Building Code, treatment rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area.
2. For shelled spaces built under the 2001 or prior California Building Code, treatment rooms shall have no less than 80 square feet (7.43 m<sup>2</sup>) of clear floor area per bed.
3. Darkroom is optional. If provided, shall be convenient to the treatment room(s)
4. Patient gowning area with provision for safe storage of valuables and clothing and with direct access to toilet room(s). At least one space shall be large enough for staff-assisted dressing.
5. Film files area is optional. If provided shall have storage for unprocessed film.

**1224.34.4 Additional support areas for linear accelerator.**

**1224.34.4.1** Mold room with exhaust hood and handwashing fixture.

**1224.34.4.2** Block room with storage. The block room may be combined with the mold room.

**1224.34.5 Additional support areas for cobalt room.**

**1224.34.5.1** Hot lab.

**1224.34.6** High dose rate brachytherapy room.

## **1224.35 REHABILITATION THERAPY DEPARTMENT.**

**1224.35.1 Rehabilitation center space.** If provided, a rehabilitation center space shall be designed to meet the requirements of Section 1224.14, except as follows:

1. Patient bedrooms shall contain a minimum of 110 square feet (10.22 m<sup>2</sup>) of clear floor area per bed, exclusive of toilet room(s), closets, lockers, wardrobes, alcoves or vestibules, with greater space provided for special needs such as circ-o-electric beds.
2. Space for group dining shall be provided at the minimum rate of 20 square feet (1.86 m<sup>2</sup>) per bed.

3. Space for group recreation or patient's lounge shall be provided at the minimum rate of 20 square feet (1.86 m<sup>2</sup>) per bed.
4. Space for staff conferences, patient evaluation, and progress reports.
5. A classroom space.
6. An examination and treatment room, adjacent or directly accessible to an office for the physician in charge of the outpatient service.
7. A patient waiting area with access to telephone, drinking fountain, and men's and women's toilet room facilities in or adjacent to the rehabilitation outpatient service area.
8. Access to an outside area to be used for therapeutic procedures for patients.
9. At least one training toilet room in each patient unit with minimum dimensions of 5 feet by 6 feet (1524 mm by 1829 mm).
10. Patient bathtubs, where provided, of standard height and located to provide access to both sides and one end of the tub.
11. Patient showers, where provided, shall have a minimum floor area of 16 square feet (1.49 m<sup>2</sup>), no dimension of which shall be less than 4 feet (1219 mm), be equipped with handrails, privacy curtains, and designed for ease of accessibility. The floor shall be sloped to provide drainage.

**1224.35.2 Physical therapy service space.** If physical therapy is part of the service, the following shall be included:

1. Individual treatment area(s) with privacy screens or curtains. Each such space shall have not less than 70 square feet (6.51 m<sup>2</sup>) of clear floor area.
2. Handwashing fixtures for staff either within or at each treatment space. (One handwashing fixture may serve several treatment stations.)
3. Exercise area and facilities.
4. Clean linen and towel storage.
5. Storage for equipment and supplies.
6. Separate storage for soiled linen, towels, and supplies.

**Exception:** When approved by the licensing agency small or rural hospitals are exempt from Sections 1224.35.2.1 through 1224.35.2.6.

**1224.35.3 Occupational therapy service space.** If this service is provided, the following shall be included:

1. Work areas and counters suitable for wheelchair access.
2. Handwashing fixture(s).
3. Storage for supplies and equipment.
4. An area for teaching daily living activities shall be provided. It shall contain an area for a bed, kitchen

counter with appliances and sink, bathroom, and a table/chair.

**1224.35.4 Speech pathology and/or audiology service space.** If a speech pathology service is provided, space shall be provided for:

1. Tables and chairs to conduct interviews, consultations and treatment, and to accommodate patients in wheelchairs and stretchers.
2. A waiting area with access to public toilet room(s) if outpatients are being served.
3. Handwashing fixture.
4. Testing unit. If an audiology service is provided, there shall be, in addition to Items 1, 2 and 3 above, a minimum of one two-room testing unit that meets the American National Standards Institute, ANSI/ASA S-3.1, 1999, (2008) Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms.

#### **1224.36 RENAL DIALYSIS SERVICE SPACE (ACUTE AND CHRONIC)**

**1224.36.1 General.** If provided, renal dialysis service shall comply with the following:

##### **1224.36.2 Treatment area.**

**1224.36.2.1 Location.** The treatment area may be an open area and shall be separate from administrative and waiting areas.

**1224.36.2.2 Nurses' station(s).** Shall be located within the dialysis treatment area and designed to provide visual observation of all patient stations.

**1224.36.2.3 Individual patient treatment areas.** Shall contain at least 80 square feet (7.44 m<sup>2</sup>). There shall be at least a 4-foot (1219 mm) space around and between beds and/or lounge chairs.

**1224.36.2.4 Handwashing fixtures.** Shall be located convenient to the nurses' station and patient treatment areas. There shall be at least one handwashing fixture serving no more than four stations. These shall be uniformly distributed to provide equal access from each patient station.

**1224.36.2.5 Privacy.** The open unit shall be designed to provide privacy for each patient.

**1224.36.2.6 Bloodborne infection isolation room.** A minimum of one bloodborne infection isolation room of at least 120 square feet (11.15 m<sup>2</sup>) of clear floor space shall be provided for patients. This room shall contain a counter and handwashing fixture.

**1224.36.2.7 Medication dispensing.** If provided, there shall be a medication dispensing station for the dialysis center. A work counter and handwashing fixtures shall be included in this area. Provisions shall be made for the controlled storage, preparation, distribution and refrigeration of medications.

**1224.36.2.8 Home training.** If provided in the unit, a private treatment area of at least 120 square feet (11.15 m<sup>2</sup>) shall be provided for patients who are being

trained to use dialysis equipment at home. This room shall contain counter, handwashing fixtures, and a separate drain for fluid disposal.

**1224.36.2.9 Examination room.** An examination room with a handwashing fixture shall be provided with at least 100 square feet (9.29 m<sup>2</sup>).

**1224.36.2.10 Clean utility room.** A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing fixture, and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

**1224.36.2.11 Soiled utility room.** A soiled workroom shall be provided and contain a sink, handwashing fixture, work counter, storage cabinets, waste receptacles and a soiled linen receptacle.

**1224.36.2.12 Reprocessing room.** If dialyzers are reused, a reprocessing room is required and sized to perform the functions required and include one-way flow of materials from soiled to clean with provisions for a refrigerator (temporary storage or dialyzer), decontamination/cleaning areas, sinks, processors, computer processors and label printers, packaging area and dialyzer storage and disinfectants cabinets.

**1224.36.2.13 Nourishment station.** If a nourishment station for the dialysis service is provided, the nourishment station shall contain a sink, a work counter, a refrigerator, storage cabinets and equipment for serving nourishments as required.

**1224.36.2.14 Housekeeping room.** Provide adjacent to and for the exclusive use of the unit.

**1224.36.2.15 Repair room.** If required, an equipment repair and breakdown room shall be equipped with a handwashing fixture, deep service sink, work counter and storage cabinet. Needs water supply and drain connection for testing machines.

**1224.36.2.16 Supplies.** Supply areas or supply carts shall be provided.

**1224.36.2.17 Storage.** Storage space shall be available for wheelchairs and gurneys, if gurneys are provided, out of direct line of traffic.

**1224.36.2.18 Clean linen storage.** A clean linen storage area shall be provided. This may be within the clean utility room, a separate closet, or an approved distribution system. If a closed cart system is used, storage may be in an alcove. It must be out of the path of normal traffic and under staff control.

**1224.36.2.19 Mixing room.** Each facility using a central batch delivery system shall provide, either on the

premises or through written arrangements, individual delivery systems for the treatment of any patient requiring special dialysis solutions. The mixing room shall also include a sink, storage space and holding tanks.

**1224.36.2.20 Water treatment room.** The water treatment equipment shall be located in an enclosed room.

**1224.36.2.21 Patient toilet.** A patient toilet room with a lavatory shall be provided.

### **1224.36.3 Ancillary facilities.**

**1224.36.3.1 Staff lounge, lockers and toilet(s).** Space shall be available for male and female personnel for staff clothing change area and lounge. The areas shall contain lockers, shower, toilet(s), and handwashing fixtures.

**1224.36.3.2 Patient storage.** Storage for patients' belongings shall be provided.

**1224.36.3.3 Waiting room.** A waiting room, toilet room(s) with handwashing fixtures, drinking fountain, public telephone, and seating accommodations for waiting periods shall be available or accessible to the dialysis unit.

**1224.36.3.4 Administrative services.** Provide office and clinical work space.

**1224.37 RESPIRATORY THERAPY SERVICE SPACE.** If respiratory service is provided, the following elements shall be included:

1. **Storage for equipment and supplies.**
2. **Space and utilities for cleaning and disinfecting equipment.** Provide physical separation of the space for receiving and cleaning soiled materials from the space for storage of clean equipment and supplies. Appropriate local exhaust ventilation shall be provided if glutaraldehyde or other noxious disinfectants are used in the cleaning process. This space may be co-located with other reprocessing functions within the hospital.
3. **Additional facilities.** If respiratory services such as testing and demonstration for outpatients are part of the program, additional facilities and equipment shall be provided including but not limited to:
  - 3.1. Patient waiting.
  - 3.2. A reception and control station.

**1224.38 INTERMEDIATE-CARE SERVICE SPACE.** An intermediate-care service unit shall be housed in a separate and distinct nursing unit and shall comply with the applicable requirements of Section 1225.

### **1224.39 OUTPATIENT SERVICE SPACE.**

**1224.39.1 Waiting area(s).** Provide with access to public toilet room facilities, a public telephone and a drinking fountain. These facilities may be shared with other services.



**1224.39.2 Outpatient surgery.** If outpatient surgery is performed in the outpatient service area, the following shall be provided:

1. An operating room(s) with a minimum clear floor area of 270 square feet (25.08 m<sup>2</sup>), no dimension of which shall be less than 15 feet (4572 mm).
2. Preoperative patient holding shall be provided in accordance with Section 1224.15.2.
3. A postanesthesia recovery area which meets the requirements of Section 1224.16.
4. Each surgical unit shall provide a separate cleanup room separated from any surgical sterilizing facilities. The cleanup room shall provide 24 square feet (2.2 m<sup>2</sup>) per operating room up to eight operating rooms and shall have the minimum area of 48 square feet (4.5 m<sup>2</sup>), with no dimension less than 6 feet (1829 mm).
5. Scrub sinks which meet the requirements of Section 1224.15.3.5.
6. Service areas which meet the requirements of Section 1224.15.3.
7. A housekeeping room shall be provided for the exclusive use of outpatient surgery. It shall be directly accessible from the service area.

**1224.39.3 Gastrointestinal endoscopy.** If gastrointestinal endoscopy is performed in the outpatient service area, the endoscopy suite shall be divided into a minimum of three major functional areas: the procedure room(s), instrument processing room(s), and patient holding/preparation and recovery room or area and the following shall be provided:

**1224.39.3.1 Procedure room(s).**

**1224.39.3.1.1 Space requirements.** Procedure room shall have a minimum clear floor area of 200 square feet (18.6 m<sup>2</sup>). Room arrangement shall permit a minimum clearance of 3 feet, 6 inches (1067 mm) at each side, head, and foot of the gurney/table.

**1224.39.3.1.2 Handwashing fixture.** A separate dedicated handwashing station with hands-free controls shall be available in the procedure room.

**1224.39.3.2 Processing room.**

**1224.39.3.2.1 Dedicated processing room(s)** for cleaning and decontaminating instruments shall be provided. The cleaning area shall allow for flow of instruments from the contaminated area to the clean assembly area and then to storage.

**1224.39.3.2.2 The decontamination area** shall be equipped with the following:

1. Utility sink(s) shall be provided as appropriate to the method of decontamination used.
2. One freestanding handwashing station.
3. Work counter space(s).

**1224.39.3.3 Pre-operative patient holding.** A pre-operative patient holding area shall be provided in accordance with Section 1224.15.2.

**1224.39.3.4 Post-anesthesia recovery area.** A post-anesthesia recovery area shall meet the requirements of Section 1224.16.

**1224.39.3.5 Communication system.** A system for emergency communication shall be provided.

**1224.39.4 CANCER TREATMENT/INFUSION THERAPY SERVICE SPACE.**

**1224.39.4.1 General.** If provided, cancer treatment/infusion therapy service shall comply with the following:

**1224.39.4.2 Treatment area.**

**1224.39.4.2.1 Location.** The treatment area may be an open area and shall be separated from administrative and waiting areas.

**1224.39.4.2.2 Nurses' station(s).** Shall be located within the cancer treatment/infusion therapy area and designed to provide visual observation of all patient stations.

**1224.39.4.2.3 Individual patient treatment areas.** Shall contain at least 80 square feet (7.4 m<sup>2</sup>).

There shall be at least a 4-foot (1219 mm) space around and between beds and/or lounge chairs used for chemotherapy treatment/infusion.

**1224.39.4.2.4 Handwashing fixtures.** Shall be located convenient to the nurses' station and patient treatment areas. There shall be at least one handwashing fixture serving no more than four patient stations. These shall be uniformly distributed to provide equal access from each patient station.

**1224.39.4.2.5 Privacy.** The open unit shall be designed to provide privacy for each patient.

**1224.39.4.2.6 Medication dispensing.** If provided, there shall be a medication dispensing station for the cancer treatment/infusion therapy area. A work counter and handwashing fixture(s) shall be included in the area. Provisions shall be made for the controlled storage, preparation, distribution and refrigeration of medications.

**1224.39.4.2.7 Examination room.** An examination room with a handwashing fixture shall be provided with at least 100 square feet (9.29 m<sup>2</sup>).

**1224.39.4.2.8 Clean utility room.** A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing fixture, and storage facilities for clean and sterile supplies. If the room is used for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

**1224.39.4.2.9 Soiled utility room.** A soiled workroom shall be provided and contain a sink, handwashing fixture, work counter, storage cabinets, waste receptacles and a soiled linen receptacle.

**1224.39.4.2.10 Nourishment station.** If nourishment station for the cancer treatment/infusion therapy service is provided, the nourishment station shall contain a sink, a work counter, a refrigerator, storage cabinets and equipment for serving nourishment as required.

**1224.39.4.2.11 Housekeeping room.** Adjacent to and for the exclusive use of the unit.

**1224.39.4.2.12 Supplies.** Supply areas or supply carts shall be provided.

**1224.39.4.2.13 Storage.** Storage space shall be available for wheelchairs and gurneys. If gurneys are provided, they shall be out of the direct line of traffic.

**1224.39.4.2.14 Clean linen storage.** A clean linen storage area shall be provided. This may be within the clean utility room, a separate closet, or an approved distribution system. If a closed cart system is used, storage may be in an alcove. It must be out of the path of normal traffic and under staff control.

**1224.39.4.2.15 Patient toilet.** A patient toilet room with a lavatory shall be provided.

**1224.39.4.3 Ancillary facilities.**

**1224.39.4.3.1 Staff lounge, lockers and toilet(s).** Space shall be available for male and female personnel for staff clothing change area and lounge. The areas shall contain lockers, toilet(s), and handwashing fixtures.

**1224.39.4.3.2 Patient storage.** Storage for patients' belongings shall be provided.

**1224.39.4.3.3 Administrative services.** Office and clinical work space shall be provided.

**1224.39.4.3.4 Special design elements.** Decorative water features and fish tanks shall not be located inside cancer treatment/infusion therapy unit.

**1224.40 SKILLED NURSING SERVICE SPACE.** If provided a skilled nursing service unit shall be housed in a separate and distinct nursing unit and shall comply with the applicable requirements of Section 1225.

**1224.41 SOCIAL SERVICE SPACE.** If provided, the social service space shall include office or other space for privacy in interviewing, telephoning and conducting conferences.

**SECTION 1225 [OSHPD 2]  
SKILLED NURSING AND  
INTERMEDIATE-CARE FACILITIES**

**1225.1 Scope.** The provisions of this section shall apply to skilled nursing and intermediate-care facilities, including distinct part skilled nursing and intermediate-care services on a general acute-care or acute psychiatric hospital license,

provided either is in a separate unit or a freestanding building. Skilled nursing facilities and intermediate-care facilities shall provide all common elements and support services. The required services for skilled nursing and intermediate-care facility licensure: dietary, pharmacy services, and activity program shall be provided. At the option of the provider, the medical model or the household model may be used.

**1225.2 Application.** New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, California Fire Code (Parts 3, 4, 5 and 9 of Title 24), and this section.

**Exception:** See Section 1224.2.

**1225.3 Definitions.** Refer to Section 1224.3.

**1225.4 COMMON ELEMENTS.**

**1225.4.1 NURSING SERVICE SPACE.**

**1225.4.1.1 Nurses' station.** A nurses' station in free-standing skilled nursing and intermediate-care facilities shall be provided within each nursing unit. Nurses' stations shall be designed to serve no more than 60 beds.

**1225.4.1.1.1 Components.** Nurses' stations shall be provided with a cabinet, a desk, space for records, a bulletin board, a telephone, a specifically designated, lockable and illuminated medicine storage compartment, and a handwashing fixture. If a separate medicine room is provided, it shall have a lockable door and a sink. This sink cannot replace the required nurses' station handwashing fixture.

**1225.4.1.1.2 Size.** Nurses' stations serving 25 or less beds shall have a minimum floor area of 100 square feet (9.29 m<sup>2</sup>). Nurses' stations servicing more than 25 beds shall have a minimum floor area of 125 square feet (11.6 m<sup>2</sup>). The minimum dimension of any nurses' station shall not be less than 8 feet (2438 mm).

**1225.4.1.1.3 Distance.** In free-standing skilled nursing and intermediate-care facilities, the distance between the nurses station entrance and the center of the doorway of the most remote patient bedroom shall not exceed 150 linear feet (45,720 mm).

**Exception:** The 150-foot (45,720 mm) limit does not apply to distinct part skilled nursing and intermediate-care services provided as a separate unit in a general acute-care hospital or acute psychiatric hospital.

**1225.4.1.2 Room identification.** Each patient room shall be labeled with an identification number, letter, or combination of the two.

**1225.4.1.3 Utility rooms.** Utility rooms shall be provided in each nursing unit. Soiled and clean utility or holding rooms shall be separated and have no direct connection.

**1225.4.1.3.1 Clean utility room.** If the room is used for preparing patient care items, it shall contain a

work counter, a handwashing fixture, and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing fixture may be omitted.

**1225.4.1.3.2 Soiled workroom or soiled holding room.** This room shall be separate from the clean utility room. The soiled workroom/utility room shall contain a clinical sink (or equivalent flushing-rim fixture). The room shall contain a handwashing fixture. The above fixtures shall both have a hot and cold mixing faucet. The room shall have a work counter and space for separate covered containers for soiled linen and waste. Rooms used only for temporary holding of soiled material may omit the clinical sink and work counter. If the flushing-rim clinical sink is eliminated, facilities for cleaning bedpans shall be provided elsewhere.

**1225.4.1.4 Visual privacy.** A method of assuring visual privacy for each patient shall be provided in patient rooms and in tub, shower and toilet rooms.

**1225.4.1.5 Treatment or exam room.** The treatment or exam room shall comply with all of the requirements of Section 1224.4.4.

**1225.4.1.6 Toilet room and bath facilities.** Separate toilet room facilities shall be provided for the use of patients and personnel.

**1225.4.1.6.1 Grab bars.** Each toilet, bathtub and shower serving patients shall be provided with conveniently located grab bars.

**1225.4.1.6.2 Bathroom facilities.** Bathroom facilities shall be provided for patients in convenient locations in at least the following ratios:

Bathtubs or showers      1:20 patients or major fraction thereof.

(Minimum one bathtub on each floor)

Lavatories                      1:8 patients

(Fixtures shall be equipped with gooseneck spouts without aerators and may have conventional controls.)

Toilets                              1:6 patients

Fixtures serving individual patient rooms shall not be considered as meeting the required ratios for bedrooms not served by individual adjoining toilet room or bathrooms. Changes in these ratios for wards or units in which bed patients only are to be cared for, may be permitted by the enforcing agency.

**1225.4.1.7 Patient/nurse call system.** A patient/nurse call system complying with Section 517-123, California Electrical Code, shall be provided.

**1225.4.1.8 Special-purpose rooms.** Special-purpose rooms for the purpose of single-patient occupancy shall be provided at a ratio of one room for every 35 patients

or fraction thereof. Airborne infection isolation rooms may be included in determining the number of special-purpose rooms required for the facilities.

**1225.4.1.9 Airborne infection isolation rooms.** If provided, the airborne infection isolation room shall comply with all of the requirements of Section 1224.14.3.

**1225.4.1.10 Protective environment room(s).** If provided, the protective environment room shall comply with all of the requirements of Section 1224.14.4.

## 1225.4.2 DIETETIC SERVICE SPACE.

**1225.4.2.1 General.** Food service facilities and equipment shall conform with these standards, the standards of the National Sanitation Foundation, and the requirements of the local public health agency.

**1225.4.2.1.1 Distribution.** Provision(s) shall be made for transport of hot and cold foods as required, appropriate for the type of food service selected.

**1225.4.2.1.2 Dining space.** Separate dining spaces shall be provided for patients and staff. These spaces shall be separate from the food preparation and distribution areas.

**1225.4.2.1.3 Location.** The design and location of dining facilities shall encourage patient use.

**1225.4.2.1.4 Food service.** Facilities shall be furnished to provide nourishment and snacks between scheduled meal service.

**1225.4.2.2 Functional elements.** The following facilities, in the size and number appropriate for the type of food service selected, shall be provided:

**1225.4.2.2.1 Location.** Food-service areas shall be directly accessible to the entry for food supply deliveries and for the removal of kitchen wastes.

**1225.4.2.2.2 Receiving/control stations.** A control station shall be provided for the receiving and control of incoming dietary supplies.

**1225.4.2.2.3 Food preparation facilities.** Food preparation facilities shall be provided to accommodate the method of food preparation required.

1. Conventional food preparation systems require space and equipment for preparing, cooking, and baking.

2. Convenience food service systems using frozen prepared meals, bulk packaged entrees, individual packaged portions, or those using contractual commissary services require space and equipment for thawing, portioning, cooking, and baking.

**1225.4.2.2.4 Handwashing station(s).** Handwashing station(s) shall be located in the food preparation area.

**1225.4.2.2.5 Ice-making facilities.** Ice-making facilities may be located in the food preparation area or in a separate room. They shall be easily cleanable and convenient to the dietary function.

**1225.4.2.2.6 Assembly and distribution.** A patient tray assembly area shall be provided and shall be located within close proximity to the food preparation and distribution areas.

1. If food service carts are utilized, a cart distribution system shall accommodate spaces for storage, loading, distribution, receiving, and sanitizing of the food service carts. Cart circulation shall not be through food preparation areas.

**1225.4.2.2.7 Ware-washing facilities.** Ware-washing space shall be provided in a room separate from the food preparation and serving area. It shall be designed to prevent contamination of clean wares with soiled wares through cross-traffic. The clean wares shall be transferred for storage or use in the dining area without having to pass through food preparation areas.

1. Commercial-type ware-washing equipment shall be provided.
2. Space shall be provided for receiving, scraping, sorting, and stacking soiled tableware, and for transferring clean tableware to the using areas.
3. Convenient handwashing stations shall be provided in the ware-washing space.

**1225.4.2.2.8 Pot-washing facilities.** Pot-washing facilities shall include multi-compartmented sinks.

**1225.4.2.2.9 Office space.** Office or other space shall be provided for the dietician or dietetic service supervisor.

**1225.4.2.2.10 Storage.**

1. Food storage space, including cold storage, shall be provided for a supply of food of at least a 7 day staple, 2 day frozen, 2 day perishable, and an emergency food and water supply. All food shall be stored clear of the floor. The lowest shelf shall be not less than 12 inches (305 mm) above the floor or shall be closed in and sealed tight, for ease of cleaning.

As a minimum, dietary storage space shall be provided in accordance with the following schedule:

<b>Licensed Bed Capacity</b>	<b>Storage Space</b>
1 to 99 beds	2 square feet (0.19 m <sup>2</sup> ) per bed
100 to 199 beds	200 square feet (18.58 m <sup>2</sup> ) plus 1 square foot 0.0929 m <sup>2</sup> ) per bed in excess of 100 beds
200 beds and over	300 square feet (27.99 m <sup>2</sup> ), plus 1/2 square foot

(0.0465 m<sup>2</sup>) per bed  
in excess of 200 beds

Space to allow refrigeration for the storage of frozen and chilled foods shall be provided at a minimum of 2 cubic feet (0.057 m<sup>3</sup>) of usable space per bed.

2. Additional storage space for dietetic service supplies, such as paper products, equipment, tray delivery carts, etc. shall be provided.
3. Storage areas and sanitizing facilities for cans, carts, and mobile-tray conveyors shall be provided.
4. Waste, storage, and recycling facilities (per local requirements) shall be located in a separate room easily accessible to the outside for direct pickup or disposal.

**1225.4.2.2.11 Toilet rooms.** Toilet rooms shall be provided for the exclusive use of the dietary staff. They shall not open directly into the food preparation areas, but shall be in close proximity.

**1225.4.2.2.12 Lockers.** An enclosed, separate area shall be provided for dietetic service employees' clothing and personal belongings.

**1225.4.2.2.13 Housekeeping room.** A housekeeping room meeting the requirements of Section 1224.4.15 shall be located within the dietary department for the exclusive use of the dietary department.

**1225.4.2.3 Outside service.** On approval of the Licensing Agency, when food is provided by an outside food service, the facility shall maintain adequate space, equipment, and food supplies to accommodate required functional elements listed in Section 1225.4.2.2, as required to provide patient food service in the event that the outside food service is interrupted.

## SUPPORT SERVICES

### 1225.4.3 ADMINISTRATION SPACE.

**1225.4.3.1 Administration and public spaces.** An administration area shall be provided which shall include space for business, administration, admitting, public toilet room(s), lobby, and public telephone.

**1225.4.3.2 Medical record storage.** Space shall be provided for the storage of medical records.

**1225.4.3.3 Office.** An office for the director of nurses shall be provided.

### 1225.4.4 STERILE SUPPLIES.

**1225.4.4.1 Storage.** Each facility shall provide space for the storage of disposable sterile supplies or provide space for sterilization and disinfection equipment.

**Exception:** Facilities with contractual arrangements for outside autoclaving and sterilizing services.

**1225.4.4.2 Central sterile supply.** If provided, shall accommodate the following:

**1225.4.4.2.1 Minimum requirements.** A central supply and sterilizing area shall be provided. Rooms

and spaces shall accommodate the following services and equipment:

1. Soiled work area. A receiving and gross cleaning area which shall contain work space and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled material.
2. Clean work area. A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. Sterilizing space.
4. Storage. Space for sterile supplies and unsterile supplies.

**1225.4.4.2.2 Sterilizers.** All sterilizers and autoclaves which emit steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

**Exception:** Small instrument sterilizers.

#### 1225.4.5 STORAGE.

**1225.4.5.1 Required areas.** Facilities shall provide combined general and specialized storage in accordance with the following schedule:

Licensed Bed Capacity	Storage Area
1 to 10 beds	120 square feet (11.15 m <sup>2</sup> ) minimum
11 to 100 beds	12 square feet (1.11 m <sup>2</sup> ) per bed
Over 100 beds	1,200 square feet (111.48 m <sup>2</sup> ) plus 5 square feet (0.46 m <sup>2</sup> ) per bed for each bed over 100

**1225.4.5.2 Specialized storage.** Shall include those spaces identified in the dietetic food storage of Section 1225.4.2.2.10 and as follows:

**1225.4.5.2.1 Linen.** Separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m<sup>2</sup>) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m<sup>2</sup>), except where linen chutes are provided, and may be within the soiled utility room.

**1225.4.5.2.2 Supply.** One supply storage space having a minimum area of 15 square feet (1.39 m<sup>2</sup>) shall be provided in each nursing unit. Supply storage may be within the clean utility room used only as part of a system for distributing clean and sterile supplies.

**1225.4.5.2.3 Wheelchairs.** A room or space shall be provided in each nursing unit for wheelchairs and stretchers. The wheelchair and stretcher space shall have a minimum area of 15 square feet (1.39 m<sup>2</sup>).

**1225.4.5.2.4 Separate supplies.** Sterile and unsterile supplies shall be stored separately.

**1225.4.5.2.5 Location.** All storage spaces shall be directly accessible on the site of the licensed facility.

**1225.4.6 HOUSEKEEPING ROOMS.** Housekeeping rooms shall be provided to serve each department and nursing unit, and may be shared by compatible departments, except when specifically required by other sections.

**1225.4.7 LAUNDRY.** If a laundry is to be provided, the following is required in addition to the laundry room:

1. A separate soiled linen receiving, holding and sorting room with handwashing fixture.
2. A separate clean linen storage, issuing and holding room.
3. Storage for laundry supplies.

**1225.4.7.1 Outside service.** If linen is processed off site, the following shall be provided within the facility:

1. A soiled linen holding room.
2. A separate clean linen receiving and storage room.

**1225.4.8 EMPLOYEE DRESSING ROOMS AND LOCKERS.** Separate dressing rooms with toilet(s), lavatories, and lockers for male and female personnel shall be provided.

**1225.5 SKILLED NURSING UNIT MODELS.** The requirements of the Medical Model or the Household Model shall apply to the Nursing Unit(s) in its entirety.

#### 1225.5.1 MEDICAL MODEL.

**1225.5.1.1 General construction.** Skilled nursing and intermediate-care facilities shall comply with Sections 1224.4 through 1224.13 whenever applicable.

#### 1225.5.1.2 NURSING SERVICE SPACE.

**1225.5.1.2.1 Patient bedrooms.** Patients shall be accommodated only in rooms with the following minimum floor area, exclusive of toilet rooms, wardrobes, entrance vestibules, and fixed furnishings or equipment.

1. Single-patient rooms: 110 square feet (10.21 m<sup>2</sup>).
1. Multi-patient rooms: 80 square feet (7.43 m<sup>2</sup>) per bed.

**1225.5.1.2.2 Bed clearance.** A minimum distance of 3 feet (914 mm) shall be provided between beds and 4 feet (1219 mm) between the foot of beds and walls or fixed objects in multi-patient rooms, and 3 feet (914 mm) in single-patient rooms.

**1225.5.1.2.3 Patient room beds.** Patient rooms shall not be designed to permit the placement of beds more than three deep from the exterior window, but shall be of such shape and dimensions to allow for the performance of routine functions, including the easy transfer of patients to and from bed to wheelchair or wheeled stretcher. No patient room shall be designed to accommodate more than four beds.

**1225.5.1.2.4 Outside exposure.** All patient bedrooms shall have an outside exposure and shall not be below ground level.

**1225.5.1.2.5 Patient storage.** Each patient room shall be provided with wardrobe or locker spaces for clothing, toilet articles, or other personal belongings for each patient.

**Exception:** Pediatric and psychiatric patient rooms.

#### **1225.5.1.3 PHARMACEUTICAL SERVICE SPACE.**

**1225.5.1.3.1 Drug space and storage.** Adequate space shall be provided at each nursing station for the storage of drugs and preparation of medication doses.

**1225.5.1.3.2 Drug access.** All spaces and areas used for the storage of drugs shall be lockable and accessible to authorized personnel only.

**1225.5.1.3.3 Narcotics.** Specific space shall be designed for safe storage of narcotics and other dangerous drugs.

**1225.5.1.3.4 Drug refrigeration.** Facilities shall provide for storage of drugs requiring refrigeration.

**1225.5.1.3.5 Pharmacy.** The pharmacy shall not serve the general public unless a separate public entrance or a separate public serving window is utilized.

#### **1225.5.1.4 ACTIVITY PROGRAMMING SPACE.**

Designated activity areas appropriate to independent and group needs of patients shall be provided as follows:

##### **1225.5.1.4.1 Skilled nursing facilities.**

1. Recreation room. Each floor of each building accommodating six or more patients shall be provided with a recreation room with a minimum of 100 square feet (9.29 m<sup>2</sup>).
2. Recreation and dining. A minimum of 100 square feet (9.29 m<sup>2</sup>) plus 12 square feet (1.11 m<sup>2</sup>) per bed shall be provided for recreation and dining activities.

##### **1225.5.1.4.2 Intermediate-care facilities.**

1. Recreation room. Each floor of each building accommodating five or more patients shall be provided with a recreation room with a minimum of 150 square feet (13.94 m<sup>2</sup>).
2. Recreation and dining. A minimum of 30 square feet (2.79 m<sup>2</sup>) per bed for recreation and dining activities.
3. Outdoor space for activities and recreation.

**1225.5.1.4.3 Equipment and supplies.** Recreation and dining spaces shall be provided with space to store equipment and supplies.

#### **1225.5.2 HOUSEHOLD MODEL.**

**1225.5.2.1 General construction.** Skilled nursing and intermediate-care facilities shall comply with

Sections 1224.4 through 1224.13 whenever applicable, and the following sections:

**1225.5.2.1.1 Door thresholds.** Door thresholds, except where required at exterior doors and expansion joint covers, shall be designed to facilitate use of wheelchairs and carts and to prevent tripping, and shall provide a smooth and level transition from surface-to-surface.

**1225.5.2.1.2 Seating area.** A seating area(s) located out of the required egress width shall be provided along the access corridor that is used by patients.

**1225.5.2.1.3 Towel bars.** Towel bars shall be provided at each bathing facility.

**1225.5.2.1.4 Hardware.** All patient use plumbing fixtures and door operating hardware shall be equipped with lever type hardware for easy gripping and turning.

**1225.5.2.1.5 Drinking fountain.** A minimum of one drinking fountain shall be provided per resident floor, unless drinking water is available from the resident dietary area.

#### **1225.5.2.2 Cluster/household unit and resident unit.**

**1225.5.2.2.1 Design.** Each resident unit shall consist of the resident rooms, resident support areas, and resident living areas. The unit shall be designed as a cluster/household resident unit or as a resident unit with double or single loaded access corridors. If the cluster/household unit design is utilized, it shall be designed around resident support and living areas with a maximum of 20 patients per cluster/household unit. If the double or single loaded corridor resident unit design is utilized, the access corridor shall be designed so that travel distance from the entrance of the resident unit to the furthest resident room door is no more than 60 feet (18.29 m) without a change of corridor direction or a node for a resident sitting area.

**1225.5.2.2.2 Arrangement.** Each resident unit shall be arranged to avoid unnecessary and unrelated travel through the unit.

**1225.5.2.2.3 Distinct parts or neighborhoods.** Both the cluster/household unit and resident unit designs may be grouped into distinct parts or neighborhoods to a maximum of 60 patients. These distinct parts or neighborhoods composed of the resident unit(s) as described in Section 1225.5.2.2.1 may share the functional requirements of the resident support areas as described in Sections 1225.5.2.4 and 1225.5.2.5 of this code.

#### **1225.5.2.3 Resident room.**

**1225.5.2.3.1 Capacity.** In new construction and additions, the maximum room capacity shall be two patients. Resident sleeping areas in all double resident room designs shall be visually separated from each other by a full height wall or a permanently

installed sliding or folding door or partition, and shall provide each patient direct use of and direct access to an exterior window at all times. Walls, doors, or partitions used to separate resident beds shall provide visual and acoustical separation. A door leading to each resident bed area in addition to the corridor door is not required. Other resident room arrangements where a permanent partition or door is not used to separate the resident sleeping areas may be utilized if adequate visual separation such as a cubicle curtain(s) and an exterior window for each individual resident sleeping area is provided. In this case individual thermostats for the resident bed areas shall not be required.

**1225.5.2.3.2 Renovation.** Where renovation work is undertaken of the resident room that alters the physical configuration of the resident room and the present capacity is more than two patients, the maximum room capacity shall be no more than two patients at the conclusion of the renovation.

**1225.5.2.3.3 Space requirements.** Rooms shall have a minimum of 100 square feet (9.29 m<sup>2</sup>) of clear floor area per bed in double resident rooms and 120 square feet (11.15 m<sup>2</sup>) of clear floor area in single resident rooms, exclusive of the space consumed by toilet rooms, closets, lockers, wardrobes, lavatories, alcoves, and door swings into the room or entrance vestibules, whichever is greater. For the purpose of minimum clear floor area, the entrance vestibule is defined as that floor area located between the room entrance door and the room floor area containing the resident bed(s).

**1225.5.2.3.4 Arrangement.** Dimensions and arrangement of resident rooms shall be designed to accommodate at least two bed positions to provide patient choice of bed placement. All such bed positions shall be designed so that the bed will not obstruct access to the supporting utilities serving the bed, such as the nurse call station, and the required electrical outlets that provide service for that bed. Only one bed position design shall be required for a bed that is equipped with a piped medical gas headwall unit, unless special requirements such as providing care for bariatric patients does permit the design of two bed positions in the room.

**1225.5.2.3.5 Clearance.** A 3 feet (0.91 m) wide clear access to each bed shall be provided along at least 75 percent of the length of one side of the bed and shall be designed to allow access for the use of a wheelchair and other portable equipment. For beds equipped with a piped-in medical gas headwall unit, there shall be a minimum of 3 feet (0.91 m) between the sides and foot of the bed and any wall or any other fixed obstruction. For planning purposes, a full-size bed is assumed to be 3 feet 6 inches (1.07 m) wide by 8 feet (2.43 m) long.

**1225.5.2.3.6 Renovations.** For renovations that alter the physical configuration of the resident room

but have existing structural limitations that require two resident beds to be located in a shared resident sleeping area, there shall be a minimum of 3 feet (0.91 m) between the sides and foot of the bed and the adjacent bed. If one bed must be located to the side of the other bed, there shall be a clearance of 4 feet (1.22 m) to any fixed obstruction available at the foot of this bed to permit the passage of equipment and bed without moving the resident's bed located nearest to the room door.

**1225.5.2.3.7 Resident toilet or bath room.** Each patient shall have access to a toilet room without having to enter the general corridor area or the resident bed area in a shared resident room. One toilet room shall serve no more than two patients and no more than two resident rooms. The door to the toilet room shall be side hinged and either swing out from the toilet room, or be equipped with emergency release hardware. Sliding doors equipped with sliding door hardware located on the resident room side of the wall and not equipped with a bottom door track shall be permitted. If a sliding door is used in a resident toilet or bath room, a D-shaped handle at least 4 inches (10.16 cm) long shall be provided to open the door. The sliding door shall permit access, and negate the need to push against a patient who may have collapsed within the toilet room. Unless otherwise required by this code, this door shall be at least 36 inches (914.4 mm) wide. A lavatory shall be provided in each resident toilet room.

**1225.5.2.3.8 Wardrobe closet.** Each resident room shall be provided with a wardrobe or closet for each patient. Each wardrobe or closet shall have minimum inside dimensions of 2 feet (0.61 m) in depth by 1 foot 8 inches (0.51 m) in width. Each shall be accessible to the patient at all times and shall have adjustable shelf(s) and an adjustable clothes rod that is adjustable in at most 4 inches (10.16 cm) increments from 4 feet (1.22 m) to 5 feet 8 inches (1.73 m) above finished floor or higher as closet size permits. When the wardrobe or closet is designed to meet the requirements for accessibility per Chapter 11B of this code, it shall include additional accessible storage area(s) for full-length garments. The shelf may be omitted if the clothing unit provides at least two drawers. Locked storage for personal items shall be provided within the resident sleeping room or area.

#### **1225.5.2.4 Resident support area.**

**1225.5.2.4.1 Features and arrangement.** Size and features of each resident support area will depend upon the number and type of patients served. The resident support area may be arranged and located to serve more than one resident unit, but at least one such support area shall be provided on each resident floor. The following resident support areas shall be located in or be readily accessible to each resident unit.

**1225.5.2.4.2 Staff work area.** A centralized staff work area shall be provided. It shall have space for supervisory administrative work activities, charting, and storage. In each resident unit, the functions of administrative work, charting and storage may be located among several separate direct care staff work areas. In this case, a centralized staff work area is not required.

**1225.5.2.4.3 Clean utility.** A clean utility or clean holding room for storage and distribution of clean supply materials shall be provided. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing fixture, and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as a part of a system for distribution of clean and sterile supply materials, the work counter and handwashing fixture requirements may be omitted. The minimum size of the room shall be 15 square feet (1.39 m<sup>2</sup>) with 1 square foot (0.092 m<sup>2</sup>) of additional space provided per patient for over 15 patients and may be allocated among several clean utility or clean holding rooms or closets.

**1225.5.2.4.4 Soiled utility.** A soiled utility or soiled holding room(s) shall be provided. The soiled utility function shall be comprised of a flushing rim clinical service sink or other appropriate flushing fixture, with bedpan rinsing device, soiled linen receptacles, waste receptacles and a work counter with a usable minimum work surface area of 6 square feet (0.56 m<sup>2</sup>). The total minimum size of the room shall be 20 square feet (1.86 m<sup>2</sup>) with 1.5 square feet (0.140 m<sup>2</sup>) of additional space provided per patient for over 15 patients and may be allocated among several soiled utility or soiled holding rooms. Rooms used only for the holding of soiled materials need contain only a handwashing fixture.

**1225.5.2.4.5 Medicine preparation.** A medicine preparation room or a self contained medicine dispensing unit shall be provided for the provision of medication distribution. The self-contained medicine dispensing unit shall be under the visual control of the staff. If a medicine preparation room is utilized, it shall be equipped with a lockable door, have a minimum area of 50 square feet (4.65 m<sup>2</sup>) and shall contain a refrigerator, locked storage for controlled drugs, a handwashing fixture, and a work counter with a minimum of 6 square feet (0.56 m<sup>2</sup>) of work surface. If a self-contained medicine dispensing unit is utilized, it may be located at the nurses' station, in the clean utility room, in an alcove, or in other spaces convenient for staff control provided the area occupied by the unit does not encroach upon required minimum areas. The dispensing unit may be used in a medicine preparation room as locked storage for controlled drugs within the minimum area of 50 square feet (4.65 m<sup>2</sup>), however, the standard "cup sinks" provided in many self-contained units shall not be a substitute for the

required handwashing fixture. If there is no linen storage in the clean utility room, medicine preparation may be part of the clean utility room in which case an additional 20 square feet (1.8 m<sup>2</sup>) dedicated for this purpose shall be required. A refrigerator shall also be required if medicine preparation is included in this room. Non-controlled prescription drugs may be stored inside the resident's sleeping room or toilet room if they are secured inside of an automatic closing and automatic locking dispensing unit that is secured in place.

**1225.5.2.4.6 Equipment storage.** An equipment storage room(s) shall be provided for storage of resident unit equipment. The minimum area required shall be equal to 2 square feet (0.19 m<sup>2</sup>) for each patient with no room being less than 20 square feet (1.86 m<sup>2</sup>) in area.

**1225.5.2.4.7 Housekeeping room.** A housekeeping room(s) shall be provided for storage and use of housekeeping supplies and equipment.

**1225.5.2.4.8 Clean linen room.** A clean linen storage room, closet, or area shall be provided. This area may be located within the clean utility or clean holding room and shall be large enough to accommodate the storage of linen carts.

**1225.5.2.4.9 Nourishment room.** A nourishment room or area for serving nourishments between meals shall be provided and shall contain a work counter, refrigerator, storage cabinets, and sink. Ice for patients' consumption shall be provided by an icemaker unit that may serve more than one nourishment station if the nourishment stations are in close proximity to each other. Where the icemaker unit is accessible to patients or the public, it shall be a self-dispensing type. The nourishment room shall include space for trays and dishes used for nonscheduled meal service. A handwashing fixture shall be in or immediately accessible from the nourishment room.

**1225.5.2.4.10 Storage alcove.** A storage alcove space for a wheelchair(s) shall be provided in an area located out of the required means of exit access.

**1225.5.2.4.11 Resident bathing facilities.** Resident bathing facilities shall be provided with a minimum of one bathtub or one hydro tub per resident unit, or one shower for every 20 patients or fraction thereof not otherwise served by bathing facilities in resident rooms. When centralized bathing is provided, patients shall have access to at least one bathing room per floor or unit sized to permit assisted bathing in a tub or shower in that resident unit. The bathtub in this room shall be accessible to patients in wheelchairs and the shower shall accommodate a shower chair. Other tubs or showers shall be in individual rooms or curtained enclosures with space for private use of the bathing fixture, for drying and dressing, and access to a grooming location containing a sink, mirror, and counter or shelf. A separate private toilet shall be provided that is directly



accessible to each multi-bathing fixture central bathing area without requiring entry into the general corridor. This toilet may also serve as a toilet training facility. This centralized bathing area shall comply with Chapter 11B of this code.

**1225.5.2.4.12 Private bathing.** All showers located in bathrooms connected directly to the resident room shall be designed so that a shower chair can be easily rolled over the threshold. Resident rooms and associated toilet rooms, required to be accessible, shall comply with Chapter 11B of this code.

#### **1225.5.2.5 Resident living area.**

**1225.5.2.5.1 Dining.** Dining, lounges, and recreation and social areas for patients shall be provided in each resident unit. The total area of these spaces shall be a minimum of 35 square feet (3.25 m<sup>2</sup>) per patient with a minimum total area of 225 square feet (20.90 m<sup>2</sup>). At least 20 square feet (1.86 m<sup>2</sup>) per patient shall be available for dining. Storage for supplies and equipment shall be provided in the recreation area.

**1225.5.2.5.2 Outdoor area.** Outdoor area(s) shall be provided for the use of all patients and shall include walking paths of durable materials, benches, shaded areas, and visual focusing element(s) such as landscaping, sculpture(s), or fountain(s). Security fencing if used shall be of a residential design and provide some visual connection to the exterior of the secured area. If an exterior visual connection is not possible or desirable, then the interior of the outside area shall be landscaped to be visually interesting.

**1225.5.2.5.3 Storage.** Storage for supplies, patient needs, and recreation shall be provided. The minimum required area shall be 5 square feet (0.46 m<sup>2</sup>) per bed up to 600 square feet (55.74 m<sup>2</sup>).

**1225.5.2.5.4 Dietary area.** A resident dietary area shall be provided in the resident unit for the use of staff, patients, and family. The resident dietary area may include cooking equipment, counter tops, kitchen sink, and storage areas. This dietary area is in addition to the dietetic service space requirements in Section 1225.4.2.

**1225.5.2.5.5 Therapy unit.** If provided, physical, speech, and occupational therapy units shall comply with Sections 1225.6.2 through 1225.6.4.

**1225.5.2.5.6 Barber/beauty room.** If provided, the barber/beauty room shall be a minimum of 120 square feet (11.15 m<sup>2</sup>) with the least dimension of 10 feet (3.05 m).

**1225.5.2.5.7 Resident laundry facilities.** If provided, resident laundry facilities including washing and drying equipment may be provided for staff, family, or individual patient use for the laundering of patient's personal items. If provided they shall be readily accessible from each resident unit without requiring the user to enter another resident unit or

floor, and may be shared between two resident units. These resident laundry facilities may utilize residential laundry equipment. Each resident laundry area shall contain a handwashing fixture.

#### **1225.5.2.6 STAFF SUPPORT AREA.**

**1225.5.2.6.1 Staff lounge.** Staff lounge area(s) shall be provided. It may be shared by multiple resident units if the lounge is located so it is accessible without requiring the user to enter into or through any other resident unit.

**1225.5.2.6.2 Storage.** Lockable closets, drawers, or compartments shall be provided on the resident unit for staff and may be located in the lounge for safekeeping of staff's personal effects.

**1225.5.2.6.3 Staff toilet room.** Staff toilet room shall be provided conveniently located to each resident unit.

**1225.5.2.6.4 Multipurpose room.** At least one multipurpose room per skilled nursing facility shall be provided for conferences, meetings, and health education purposes, and shall accommodate the use of visual aids. This room shall have a minimum area of 120 square feet (11.15 m<sup>2</sup>).

**1225.5.2.6.5 Conference room.** Conference or consultation room for patient and family use shall be provided and may be shared by more than two resident units if it is centrally located to each.

#### **1225.6 OPTIONAL SERVICES.**

**1225.6.1 General.** Waiting areas and access to optional services for outpatients shall accommodate the following:

**1225.6.1.1 Outpatient waiting rooms.** Waiting rooms for outpatients shall provide a seating area and space for wheelchairs, and have public corridor access to, or provisions for, public toilet room(s), drinking fountain, and telephone.

**Note:** One waiting area may serve more than one department or service.

**1225.6.1.2 Circulation.** If x-ray examinations are to be performed on outpatients, outpatient access to the radiological spaces shall not traverse a nursing unit.

**Exception:** Satellite radiology, laboratory, pharmacy, and physical and occupational therapy space serving inpatients may be located in nursing units and inpatient treatment areas.

#### **1225.6.2 PHYSICAL THERAPY SERVICE.**

**1225.6.2.1 Area.** The minimum floor area for a physical therapy service shall be 300 square feet (27.87 m<sup>2</sup>), with no dimensions less than 12 feet (3658 mm).

**1225.6.2.2 Toilet room(s).** Toilet room facilities shall be directly accessible and allow for patient transfer activities.

**1225.6.2.3 Equipment space.** See Title 22 for required equipment.

**1225.6.2.4 Handwashing fixture.** A minimum of one handwashing fixture shall be provided.

**1225.6.3 OCCUPATIONAL THERAPY SERVICE.** An occupational therapy service shall accommodate the requirements of Sections 1225.6.2.1, 1225.6.2.2 and 1225.6.2.4.

Storage space shall be provided.

**Note:** See Title 22 for required equipment, supplies, and adaptive devices.

**1225.6.4 SPEECH PATHOLOGY AND/OR AUDIOLOGY SERVICE.** At least one space free of ambient noise shall be provided. A handwashing fixture shall be provided.

**1225.6.5 SOCIAL WORK SERVICE.** Office space for privacy in interviewing, telephoning, and conferences shall be provided.

**1225.6.6 SPECIAL TREATMENT PROGRAM SERVICE.**

**1225.6.6.1 Location.** A special treatment program service providing therapeutic services to an identified mentally disordered population group shall be located in a distinct separate unit of the facility.

**1225.6.6.2 Nursing service.** The nursing service space shall comply with Section 1225.4.1.

**1225.6.6.3 Activity program.** The activity program space shall provide a minimum of 25 square feet (2.3 m<sup>2</sup>) of dining and recreation space per bed.

**1225.6.6.4 Indoor and outdoor space.** Shall be designated for the special treatment program.

## SECTION 1226 [OSHPD 3] CLINICS

**1226.1 Scope.** The provisions of this section shall apply to outpatient clinical services of a hospital when provided in a freestanding building, primary care clinics, specialty clinics, and psychology clinics. Primary care clinics include free clinics, community clinics, employee clinics and optometric clinics. Specialty clinics include surgical clinics, chronic dialysis clinics, rehabilitation clinics and alternative birth centers (ABC).

**1226.2 Application.** All new buildings and additions, alterations or repairs to existing buildings, and conversion of space to a clinic use within existing buildings, subject to licensure by Licensing and Certification, California Department of Public Health, shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, California Fire Code, (Parts 3, 4, 5, and 9 of Title 24) and this section. OSHPD requirements apply to all facilities described above and are not dependent upon Occupancy Group designations.

**Exception:** See Section 1224.2.

**1226.2.1 Outpatient clinical services.** Hospitals providing outpatient clinical services and clinics licensed under Health and Safety Code Section 1200 providing services that are not covered by this section shall meet the applicable requirements in Section 1224.

**1226.2.2 Special services.** A general acute care hospital referenced in Health and Safety Code Section 1255 (d) (3) (E), that provides special services in conformance with Health and Safety Code Section 1255, shall meet all the provisions of Section 1224.28.3 in addition to Section 1226.2. The Office of Statewide Health Planning and Development (OSHPD) shall review any proposed construction or alteration for OSHPD compliance.

**1226.3 Definitions.** Refer to Section 1224.3.

**1226.4 General construction.** Clinics and outpatient clinical services under a hospital license shall comply with the following provisions wherever applicable.

**1226.4.1 Examination and treatment areas.**

**1226.4.1.1 Service spaces.** Refer to Section 1224.4.2.

**1226.4.1.2 Treatment spaces.** Refer to Section 1224.4.3.

**1226.4.1.3 Examination or treatment room.** Refer to Section 1224.4.4.1.

**1226.4.1.4 Airborne infection isolation exam/treatment room.** Refer to Section 1224.4.4.1.1.

**1226.4.2 Miscellaneous requirements.**

**1226.4.2.1 Station outlets.** When provided, refer to Section 1224.4.6.1.

**1226.4.2.2 Gas and vacuum systems.** When provided refer to Section 1224.4.6.2.

**1226.4.2.3 Hyperbaric facilities.** When provided, refer to Section 1224.4.6.3.

**1226.4.2.4 Laboratories.** Refer to Section 1224.4.6.4.

**1226.4.2.5 Nurse call systems.** Refer to Section 1224.4.6.5.

**1226.4.3 Corridors.**

**1226.4.3.1 Outpatient services.** Refer to Section 1224.4.7.3

**1226.4.3.2 Corridor width.** For clinics with bed/gurney patient(s) refer to Section 1224.4.7.1.

**1226.4.3.3 Light traffic.** Refer Section 1224.4.7.2.

**1226.4.3.4 Handrails.** For rehabilitation services space, refer to Section 1224.4.7.4.

**1226.4.3.5 Connections.** Refer to Section 1224.4.7.5.

**1226.4.4 Doors and door openings.**

**1226.4.4.1 Toilet room doors.** Refer to Section 1224.4.8.1.

**1226.4.4.2 Pocket doors.** Refer to Section 1224.4.8.2.

**1226.4.5 Windows.**

**1226.4.5.1 Window screens.** Refer to Section 1224.4.9.4.

**1226.4.5.2 Light and ventilation.** Refer to Section 1224.4.9.5.

**1226.4.6 Ceiling heights.**

**1226.4.6.1 Minimum height.** For minimum ceiling height requirements, refer to Section 1224.4.10.1.

**1226.4.6.2 Minimum height with fixed ceiling equipment.** Refer to Section 1224.4.10.2.

#### **1226.4.7 Interior finishes.**

**1226.4.7.1 Floor finishes.** Refer to Section 1224.4.11.1 and Table 1224.4.11.

**1226.4.7.1.1 Coved base.** Refer to Section 1224.4.11.1.1.

**1226.4.7.1.2 Wet cleaning.** Refer to Section 1224.4.11.1.3.

**1226.4.7.1.3 Airborne infection isolation exam/treatment room.** Refer to Section 1224.11.1.4.

#### **1226.4.7.2 Wall bases.**

**1226.4.7.2.1 Material.** Refer to Section 1224.4.11.2.1.

**1226.4.7.2.2 Wet cleaning.** Refer to Section 1224.4.11.2.2.

**1226.4.7.3 Walls finishes.** Refer to Section 1224.4.11.3.

**1226.4.7.4 Ceilings.** Ceiling finishes shall comply with Section 1224.4.11.4 and Table 1224.4.11.

#### **1226.4.8 Elevators.**

**1226.4.8.1 Elevator cab requirements.** Buildings over one story in height with accommodations or services for patients on floors without grade-level entrance shall provide at least one elevator in compliance with Section 3002.4.

**1226.4.8.2 Dimensions.** Elevators used for the routine transport of wheeled stretchers shall have minimum inside platform dimensions of 5 feet by 8 feet (1524 mm by 2438 mm) and a minimum clear door opening of 3 feet 8 inches (1118 mm).

**1226.4.9 Garbage, solid waste, medical waste and trash storage.** These facilities shall comply with the appropriate local health and environmental authorities' requirements, California Department of Public Health requirements for medical waste management, and comply with the following minimum requirements:

**1226.4.9.1 Location.** A location shall be provided for waste collection and storage with sufficient space based upon the volume of projected waste and length of anticipated storage. The location of compactors, balers, sharps containers, and recycling container staging at docks or other waste removal areas shall comply with Section 1224.4.2.

**1226.4.9.2 Enclosure.** A lockable room or screened enclosure of at least 25 square feet (2.32 m<sup>2</sup>) shall be provided for the washing and cleaning of garbage containers and for the storage of garbage, trash and other solid wastes.

**Exception:** This amount of space may not be required by the enforcing agency if there is a proposed method of handling and storage which requires a lesser amount of space. Additional space may be required by the enforcing agency when spe-

cial operations or collection and disposal methods result in greater than usual accumulation of solid wastes.

The room or screened enclosure shall include the following:

1. **Floor and curb.** A concrete floor with a curb and with a drain connected to the sewer.
2. **Water.** Steam or hot water and cold water supplies in accordance with the California Plumbing Code.
3. **Size.** A minimum floor area of not less than 25 square feet (2.32 m<sup>2</sup>), the least dimension of which shall be 4 feet (1219 mm). This amount of space may not be required by the enforcing agency if there is proposed a method of handling, storage, or cleaning of containers which requires a lesser amount of space. Additional space may be required by the enforcing agency when special operations or collection and disposal methods result in greater than usual accumulation of solid wastes.

**1226.4.9.3 Waste holding room.** As an alternative to the requirements in Section 1226.4.9.2, a holding room for medical waste and garbage may be provided.

**Exception:** This amount of space may not be required by the enforcing agency if there is a proposed method of handling and storage which requires a lesser amount of space. Additional space may be required by the enforcing agency when special operations or collection and disposal methods result in greater than usual accumulation of solid wastes.

The waste holding room shall comply with the following:

1. The waste holding room shall be a minimum of 25 square feet, with the least dimension of which is 4 feet.
2. The waste holding room shall have 100 percent exhaust ventilation.
3. All finishes in the waste holding room shall comply with the requirements in Section 1224.4.11.
4. The waste holding room shall have convenient access to an exterior door.

**1226.4.10 Compactors.** Trash compactor systems shall meet the drainage and wash-down requirements under Section 1226.4.9.2, Items 1 and 2.

**Exception:** If a dumpster system is proposed, operational procedures for handling and storage must be specifically approved by the local health officials.

**1226.4.11 Housekeeping room.** Refer to Section 1224.4.15.

**1226.4.12 Laundry and trash chutes.** Gravity-type laundry and trash chutes shall comply with Section 1224.4.16.

**1226.4.13 Support areas for examination and treatment rooms.**

**1226.4.13.1 Administrative center(s) or nurse station(s).** This area shall have space for counters and storage and shall have convenient access to handwashing fixtures (refer to Section 1224.3 for definition of handwashing fixture). It may be combined with or include centers for reception, charting and communication.

**1226.4.13.2 Medication station.** Provision shall be made for distribution of medications. This shall be done from a medicine preparation room or a self-contained medicine dispensing unit.

**1226.4.13.2.1 Medicine preparation room or area.** When provided, the entry of the medicine preparation room or area shall be under the visual control of the staff. This may be a part of the administrative center or nurse station and shall include all of the following:

1. Work counter
2. Sink
3. Lockable refrigerator
4. Convenient access to handwashing fixture
5. Locked storage for biologicals and drugs

When a medicine preparation room or area is to be used to store self-contained medicine dispensing units, the room shall be designed with adequate space to prepare medicines with the self-contained medicine-dispensing units present.

**1226.4.13.2.2 Self-contained medicine-dispensing unit.** When provided, the location of a self-contained medicine-dispensing unit shall be permitted in the clean workroom or at the administrative center or nurses' station, provided there is adequate security for medications and adequate lighting to easily identify drugs. Convenient access to handwashing fixture shall be provided.

**1226.4.13.3 Clean utility room.** A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain:

1. Work counter
2. Handwashing fixture
3. Storage facilities for clean and sterile supplies

If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

**1226.4.13.4 Soiled workroom or soiled holding room.** Soiled workroom or soiled holding room shall be provided and contain:

1. Clinic sink

**Exception:** For primary care clinics, a utility sink or patient toilet room equipped with a bed-pan flushing device may be provided in lieu of a

clinic sink. A utility sink may be used for soaking or rinsing and shall be provided as appropriate to the method of decontamination used.

2. Handwashing fixture
3. Work counter
4. Storage cabinets
5. A designated area for waste receptacle(s)
6. A designated area for soiled linen receptacle(s)

Where rooms are used for temporary holding of materials, provisions shall be made for separate collection, storage, and disposal of soiled materials. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

**1226.4.13.5 Sterile and pharmaceutical supply storage.** Separate storage for sterile supplies and pharmaceutical supplies shall be provided.

**1226.4.13.6 Sterilization facilities.** When provided, a sterilization facility shall meet the following applicable requirements:

**1226.4.13.6.1 Storage.** Each facility shall provide space for the storage of disposable sterile supplies or provide space for sterilization and disinfection equipment.

**Exception:** Facilities with contractual arrangements for outside autoclaving and sterilizing services.

**1226.4.13.6.2 Central sterile supply and sterilizing area.** When provided, rooms and spaces of the central supply and sterilizing area shall comply with the following:

1. **Soiled work area.** A receiving and gross cleaning area which shall contain work space and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled materials.
2. **Clean work area.** A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. **Sterilizing and equipment disinfection space.**
4. **Storage.** Space for sterile supplies and unsterile supplies.

**1226.4.13.6.3 Sterilizers.** When provided, all sterilizers and autoclaves which emit system steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

**Exception:** Small instrument sterilizers.

**1226.4.13.7 Nourishment room.** When provided, the nourishment room or area shall have all of the following:

1. Sink
2. Work counter

3. Refrigerator
4. Storage cabinets
5. Equipment for serving nourishment
6. A handwashing fixture, as defined in Section 1224.3, shall be located in the nourishment room or adjacent to the nourishment area.

**1226.4.14 Support areas for patients.**

**1226.4.14.1 Patient toilet room(s).** Toilet room(s) with a lavatory shall be provided separate from public use toilet(s) and shall be located to permit access from patient care areas without passing through publicly accessible areas.

**Exception:** For primary care clinics where the facility contains no more than three examination and/or treatment rooms, the patient toilet room shall be permitted to serve outpatient waiting room(s).

**1226.4.14.2 Specimen and/or blood collection facilities.** When provided, refer to Section 1224.4.4.2. Use of patient toilet room(s) shall be permitted for specimen collection.

**1226.4.15 General support services and facilities.**

**1226.4.15.1 Areas for off-site laundry services.** If linen is to be processed off site, the following shall be provided:

1. Soiled linen holding area or designated and dedicated area for soiled laundry cart.
2. Clean linen storage area that protects linen from soil or damage.

**1226.4.16 Public and administrative areas.**

**1226.4.16.1 Public.**

**1226.4.16.1.1 Reception.** A reception and information counter or desk shall be provided.

**1226.4.16.1.2 Outpatient waiting rooms.** Refer to Section 1224.4.5.

**1226.4.16.2 Administrative services.**

**1226.4.16.2.1 Medical records storage.** Outpatient clinics shall provide a health record service which shall comply with the following:

1. Work area for sorting and recording records for either paper or electronic media.
2. Storage area for records for either paper or electronic media.

**1226.4.16.2.2 Equipment and supply storage.** General storage facilities for office supplies and equipment shall be provided.

**1226.4.17 Support areas for staff.**

**1226.4.17.1 Staff toilet(s).** Provide staff toilet(s) in addition to and separate from, public and patient facilities. The areas shall contain toilet(s) and handwashing fixtures pursuant to the California Plumbing Code, Table 4-2.

**1226.4.17.2 Storage for employees.** Provide storage for staff personal effects with locking drawers or cabinets (may be individual desks or cabinets). Such storage shall be convenient to individual workstations and shall be staff controlled.

**1226.4.17.3 Staff lounge.** When provided, the lounge shall have adequate space to accommodate staff.

**OUTPATIENT CLINICAL SERVICES OF A HOSPITAL**

**1226.5 OUTPATIENT CLINICAL SERVICES OF A HOSPITAL.** A licensed hospital may elect to locate certain outpatient services in a freestanding outpatient clinical services building(s). To be considered a freestanding outpatient clinical services building the building must not be physically attached to a building in which inpatient services are provided. No more than 25 percent of the services provided in an outpatient clinical services building may be rendered to inpatients. Services that duplicate the basic services may be provided in freestanding building(s). These services, defined in Subsection (a) of the Health and Safety Code Section 1250, must be in excess of the basic services, necessary for hospital licensure, required to be located in a hospital building under OSHPD jurisdiction.

Outpatient clinical services of a hospital in a freestanding outpatient clinical services building shall comply with Sections 1226.4.2 through 1226.4.8 and the provisions of this section. Outpatient clinical services of a hospital that are not addressed in the provisions of Section 1226 shall comply with applicable provisions of Section 1224.

**GENERAL SUPPORT AREAS FOR OUTPATIENT CLINICAL SERVICES - Requirements for all service types.**

**1226.5.1 Support areas for patients.**

**1226.5.1.1 Patient toilet room(s).** Refer to Section 1226.4.14.1.

**1226.5.1.2 Specimen and/or blood collection facilities.** When provided, refer to Section 1224.4.4.2.

**1226.5.2 General support services and facilities.**

**1226.5.2.1 Garbage, solid waste, medical waste, and trash storage.** Refer to Section 1226.4.9.

**1226.5.2.2 Housekeeping room.** Refer to Section 1224.4.15.

**1226.5.3 Public and administrative areas.**

**1226.5.3.1 Public area.**

**1226.5.3.1.1 Reception.** Refer to Section 1226.4.16.1.1.

**1226.5.3.1.2 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.5.3.1.3 Public toilet(s).** Refer to Section 1224.4.5.

**1226.5.3.1.4 Public telephone access.** Refer to Section 1224.4.5.

**1226.5.3.1.5 Drinking fountain(s).** Refer to Section 1224.4.5.

**1226.5.3.2 Administrative services.**

**1226.5.3.2.1 Medical records storage.** Refer to Section 1226.4.16.2.1.

**1226.5.3.2.2 Equipment and supply storage.** Refer to Section 1226.4.16.2.2.

**1226.5.4 Support areas for staff.**

**1226.5.4.1 Staff toilet(s).** Refer to Section 1226.4.17.1.

**1226.5.4.2 Storage for employees.** Refer to Section 1226.4.17.2.

**RADIOLOGICAL/IMAGING SERVICE SPACE**

**1226.5.5 Radiological/imaging service space.** When x-ray examination services, computerized tomography scanning, magnetic resonance imaging, ultrasound, and/or mammography services are provided, the radiological/imaging services space shall comply with the provisions of this section.

**1226.5.5.1 Support spaces for radiological/imaging services.** The following spaces are common to the imaging service area and are minimum requirements:

**1226.5.5.1.1 Patient toilet room(s).** In service spaces with procedure rooms that do not require dedicated patient toilets, provide a minimum of one patient toilet room within the service space, refer to Section 1226.4.14.1.

**1226.5.5.1.2 Outpatient change area.** A separate space shall be provided where outpatients change from street clothing. This shall include provisions for clothing storage, space for clothing change and gowning area. Dressing rooms shall be provided convenient to the imaging rooms.

**1226.5.5.1.3 Staff facilities.** In service space of three or more procedure rooms, staff toilet room(s) internal to the service space.

**1226.5.5.1.4 Handwashing fixtures.** Handwashing fixtures shall be located within the unit.

**1226.5.5.1.5 Imaging storage (active).** If imaging storage systems are used, provide a means of sorting and filing patient film or electronic media for immediate retrieval shall be provided.

**1226.5.5.1.6 Medication station.** Provision shall be made for locked storage of medications and drugs. Refer to Section 1226.4.13.2.

**1226.5.5.1.7 Areas for off-site laundry services.** Refer to Section 1226.4.15.1.

**1226.5.5.2 Radiation protection.** Radiation protection requirements for equipment refer to Section 1224.18.1.1.

**1226.5.6 X-ray examination services.** When provided, x-ray examination services space shall comply with the following:

1. X-ray room.
2. When shielded control alcove with protective view windows is provided, refer to Section 1224.18.1.1.
3. Fluoroscopy room, when provided, shall have a toilet room adjoining each fluoroscopy room, in addition to other toilet room facilities located adjacent to or in the immediate vicinity.

tion to other toilet room facilities located adjacent to or in the immediate vicinity.

4. Space for processing images.

5. An office or other suitable area for viewing and reporting radiographic examination.

**1226.5.7 Computerized tomography (CT) scanning.** When provided, CT services space shall comply with the requirements of Section 1224.18.3.

**1226.5.8 Magnetic resonance imaging (MRI).** When provided, MRI services space shall comply with the requirements of Section 1224.18.4.

**1226.5.9 Ultrasound.** When ultrasound is provided, refer to Section 1224.18.5.

**1226.5.10 Mammography.** When mammography is provided, refer to Section 1224.18.6.

**GASTROINTESTINAL ENDOSCOPY**

**1226.5.11 Gastrointestinal endoscopy.** When provided, gastrointestinal endoscopy services space shall comply with Section 1224.39.3 and the provisions of this section:

**1226.5.11.1 Procedure Room(s).**

**1226.5.11.1.1 Space requirements.** Refer to Section 1224.39.3.1.1.

**1226.5.11.1.2 Handwashing fixture.** Refer to Section 1224.39.3.1.2.

**1226.5.11.2 Processing room.** Refer to Section 1224.39.3.2.

**1226.5.11.3 Pre-operative patient holding.** Refer to Section 1224.15.2.

**1226.5.11.4 Post-anesthesia recovery area.** Refer to Section 1224.16.

**1226.5.11.5 Communication system.** Refer to Section 1224.39.3.5.

**1226.5.11.6 Support areas for outpatient gastrointestinal endoscopy.**

**1226.5.11.6.1 Control station.** Refer to Section 1224.15.3.1.

**1226.5.11.6.2 Medication station.** Refer to Section 1226.4.13.2.

**1226.5.11.6.3 Soiled workroom.** Refer to Section 1224.15.3.7.

**1226.5.11.6.4 Clean utility room.** Refer to Section 1224.15.3.8.

**1226.5.11.6.5 Anesthesia workroom.** Refer to Section 1224.15.3.9.

**1226.5.11.6.6 Storage room(s) for equipment and supplies used in gastrointestinal endoscopy service space.** Refer to Section 1224.15.3.10.

**1226.5.11.6.7 Staff clothing change areas.** Refer to Section 1224.15.3.11.

**1226.5.11.6.8 Housekeeping room.** Refer to Section 1224.39.2, Item 7.

**1226.5.11.6.9 Cleanup room.** Refer to Section 1224.39.2, Item 4.

**1226.5.11.6.10 Sterile and pharmaceutical supply storage.** Refer to Section 1226.4.13.5.

**1226.5.11.7 Additional support areas for patients.**

**1226.5.11.7.1 Outpatient change area.** A separate space shall be provided where patients change out of their street clothing and are prepared for the procedure. This space shall include provisions for clothing storage, toilet room(s), sink, space for clothing change and gowning area.

**NUCLEAR MEDICINE**

**1226.5.12 Nuclear medicine.** When provided, nuclear medicine services space shall comply with Section 1224.34 and the provisions of this section:

**1226.5.12.1 Radiation protection.** When provided, refer to Section 1224.34.1.1.

**1226.5.12.2 Nuclear medicine room.** Refer to Section 1224.34.1.2.

**1226.5.12.3 Radiopharmacy.** When provided, refer to Section 1224.34.1.3.

**1226.5.12.4 Support areas for nuclear medicine services.**

**1226.5.12.4.1 Cleanup.** Refer to Section 1224.34.2.2.

**1226.5.12.4.2 Dose administration area.** Refer to Section 1224.34.2.5.

**1226.5.12.4.3 Holding.** Refer to Section 1224.34.2.6.

**1226.5.12.4.4 Patient dressing rooms.** Refer to Section 1224.34.2.7.

**1226.5.12.4.5 Patient toilet room(s).** Refer to Section 1224.34.2.8.

**1226.5.12.4.6 Staff toilet room(s).** Refer to Section 1224.34.2.9.

**1226.5.12.4.7 Handwashing fixtures.** Refer to Section 1224.34.2.10.

**1226.5.12.4.8 Control desk and reception.** Refer to Section 1226.5.3.

**1226.5.12.4.9 Clean linen storage.** A storage area for clean linen shall be provided.

**1226.5.12.4.10 Soiled and contaminated material.** Refer to Section 1224.34.2.13.

**1226.5.12.5 Radiotherapy service space.** When provided, radiotherapy service space shall comply with the following provisions of this section:

**1226.5.12.5.1 Radiation protection.** Refer to Section 1224.34.3.2.

**1226.5.12.5.2 Room sizes.** Refer to Section 1224.34.3.3.

**1226.5.12.5.3 General support area.** Refer to Section 1224.34.3.4.

**1226.5.12.6 Additional support areas for linear accelerator.**

**1226.5.12.6.1 Mold room.** Refer to Section 1224.34.4.1.

**1226.5.12.6.2 Block room.** Refer to Section 1224.34.4.2.

**1226.5.12.7 Additional support areas for cobalt room.**

**1226.5.12.7.1 Hot lab.**

**1226.5.12.8 High dose rate brachytherapy room.**

**CANCER TREATMENT/INFUSION THERAPY**

**1226.5.13 Cancer treatment/infusion therapy service space.** When provided, cancer treatment/infusion therapy service space shall comply with the provisions of this section:

**1226.5.13.1 Treatment area.**

**1226.5.13.1.1 Location.** Refer to Section 1224.39.4.2.1.

**1226.5.13.1.2 Nurses' station(s).** Refer to Section 1224.39.4.2.2.

**1226.5.13.1.3 Individual patient treatment areas.** Refer to Section 1224.39.4.2.3.

**1226.5.13.1.4 Handwashing fixtures.** Refer to Section 1224.39.4.2.4.

**1226.5.13.1.5 Privacy.** Refer to Section 1224.39.4.2.5.

**1226.5.13.1.6 Medication dispensing.** Refer to Section 1224.39.4.2.6.

**1226.5.13.1.7 Examination room.** Refer to Section 1224.39.4.2.7.

**1226.5.13.1.8 Clean utility room.** Refer to Section 1224.39.4.2.8.

**1226.5.13.1.9 Soiled utility room.** Refer to Section 1224.39.4.2.9.

**1226.5.13.1.10 Nourishment station.** Refer to Section 1224.39.4.2.10.

**1226.5.13.1.11 Housekeeping room.** Refer to Section 1224.39.4.2.11.

**1226.5.13.1.12 Supplies.** Refer to Section 1224.39.4.2.12.

**1226.5.13.1.13 Storage.** Refer to Section 1224.39.4.2.13.

**1226.5.13.1.14 Clean linen storage.** Refer to Section 1224.39.4.2.14.

**1226.5.13.1.15 Patient storage.** Refer to Section 1224.39.4.3.2.

**PRIMARY CARE CLINICS**

**1226.6 PRIMARY CARE CLINICS.** Primary care clinics and outpatient clinical services of a hospital providing services equivalent to a primary care clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

**1226.6.1 Examination area.**

**1226.6.1.1 Examination room(s).** Refer to Section 1224.4.4.1.

**1226.6.2 Support areas for examination rooms.**

**1226.6.2.1 Administrative center or nurse station.** Refer to Section 1226.4.13.1.

**1226.6.2.2 Medication station.** Refer to Section 1226.4.13.2.

**1226.6.2.3 Clean utility room.** Refer to Section 1226.4.13.3.

**1226.6.2.4 Soiled workroom or soiled linen holding.** Refer to Section 1226.4.13.4.

**1226.6.3 Support areas for patients.**

**1226.6.3.1 Patient toilet room(s).** Refer to Section 1226.4.14.1.

**1226.6.3.2 Specimen collection and/or blood collection facilities.** When provided, refer to Section 1224.4.4.2.

**1226.6.4 General support services and facilities.**

**1226.6.4.1 Garbage, solid waste, medical waste and trash storage.** Refer to Section 1226.4.9.

**1226.6.4.2 Housekeeping room.** Refer to Section 1224.4.15.

**1226.6.5 Public and administrative areas.**

**1226.6.5.1 Public area.**

**1226.6.5.1.1 Reception.** Refer to Section 1226.4.16.1.1.

**1226.6.5.1.2 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.6.5.1.3 Public toilet(s).** Refer to Section 1224.4.5.

**1226.6.5.1.4 Public telephone access.** Refer to Section 1224.4.5.

**1226.6.5.1.5 Drinking fountain(s).** Refer to Section 1224.4.5.

**1226.6.5.2 Administrative services**

**1226.6.5.2.1 Medical records storage.** Refer to Section 1226.4.16.2.1.

**1226.6.5.2.2 Equipment and supply storage.** Refer to Section 1226.4.16.2.2.

**1226.6.6 Support areas for staff.**

**1226.6.6.1 Staff toilet(s).** Refer to Section 1226.4.17.1.

**1226.6.6.2 Storage for employees.** Refer to Section 1226.4.17.2.

**1226.7 PRIMARY CARE CLINICS PROVIDING ABORTION SERVICES.** Primary care clinics providing abortion services shall comply with the minimum requirements for primary care clinics in Section 1226.6 in addition to the following provisions:

**1226.7.1 Treatment room.** When provided, shall have a minimum area of 120 square feet (11.15 m<sup>2</sup>), the least

dimension of which shall be 10 feet (3048 mm), excluding such spaces as vestibules and work counters.

**Exception:** Treatment rooms used for aspiration and/or medical abortion may be, as a minimum, sized as examination rooms.

**1226.7.2 Post-abortion recovery area.** Shall have a minimum area of 60 square feet (5.57 m<sup>2</sup>) per recovery bed, with cubicle curtains for patient privacy and comply with the following requirements:

**1226.7.2.1 Clearances.**

1. The design shall provide a minimum clear dimension of 4 feet (1.22 meters) between the sides of adjacent lounge chairs and between the foot of the lounge chairs and the nearest obstruction.
2. When permanent partitions (full or partial height or width) are used to partially define the patient care station (rather than cubicle curtains), a minimum clear dimension of 3 feet (914 mm) shall be provided on the sides of the lounge chair.

**1226.7.3 Patient storage.** Space for the storage of patient clothing and personal items.

**1226.7.4 Counseling.** A room or private area of at least 60 square feet (5.57 m<sup>2</sup>) for pre-abortion and post-abortion counseling.

**SURGICAL CLINICS**

**1226.8 SURGICAL CLINICS.** Outpatient surgical clinics, and outpatient clinical services of a hospital providing services equivalent to a surgical clinic, shall comply with Sections 1226.4.2 through 1226.4.8 and the provisions of this section.

**1226.8.1 Outpatient surgical service space.**

**1226.8.1.1 Operating room(s).** Refer to Section 1224.39.2, Item 1.

**1226.8.1.2 Preoperative patient holding.** Refer to Section 1224.15.2.

**1226.8.1.3 Post-anesthesia recovery area.** Refer to Section 1224.16.

**1226.8.2 Support areas for outpatient surgery.**

**1226.8.2.1 Control station.** Refer to Section 1224.15.3.1.

**1226.8.2.2 Supervisor's office or station.** Refer to Section 1224.15.3.2.

**1226.8.2.3 Substerile areas.** When provided, refer to Section 1224.15.3.3.

**1226.8.2.4 Medication station.** Refer to Section 1226.4.13.2.

**1226.8.2.5 Scrub facilities.** Refer to Section 1224.15.3.5.

**1226.8.2.6 Clock.** Refer to Section 1224.15.3.6.

**1226.8.2.7 Soiled workroom.** Refer to Section 1224.15.3.7.

**1226.8.2.8 Clean utility room.** Refer to Section 1224.15.3.8.



**1226.8.2.9 Anesthesia workroom.** Refer to Section 1224.15.3.9.

**1226.8.2.10 Equipment storage room(s) for equipment and supplies used in outpatient surgery.** Refer to Section 1224.15.3.10.

**1226.8.2.11 Staff clothing change areas.** Refer to Section 1224.15.3.11.

**1226.8.2.12 Housekeeping room.** Refer to Section 1224.39.2, Item 7.

**1226.8.2.13 Cleanup room.** Refer to Section 1224.39.2, Item 4.

**1226.8.2.14 Sterile and pharmaceutical supply storage.** Refer to Section 1226.4.13.5.

**1226.8.2.15 Sterilization facilities.** Refer to Section 1226.4.13.6.

### **1226.8.3 Support areas for patients.**

**1226.8.3.1 Patient toilet room(s).** Refer to Section 1226.4.14.1.

**1226.8.3.2 Outpatient change area.** A separate space shall be provided where patients change out of their street clothing and are prepared for the procedure. This space shall include provisions for clothing storage, toilet room(s), sink, space for clothing change and gowning area.

### **1226.8.4 General support services and facilities.**

**1226.8.4.1 Garbage, solid waste, medical waste and trash storage.** Refer to Section 1226.4.9.

**1226.8.4.2 Areas for off-site laundry services.** Refer to Section 1226.4.15.1.

### **1226.8.5 Public and administrative areas.**

#### **1226.8.5.1 Public area.**

**1226.8.5.1.1 Reception.** Refer to Section 1226.4.16.1.1.

**1226.8.5.1.2 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.8.5.1.3 Public toilet(s).** Refer to Section 1224.4.5.

**1226.8.5.1.4 Public telephone access.** Refer to Section 1224.4.5.

**1226.8.5.1.5 Drinking fountain(s).** Refer to Section 1224.4.5.

#### **1226.8.5.2 Administrative services**

**1226.8.5.2.1 Medical records storage.** Refer to Section 1226.4.16.2.1.

### **1226.8.6 Support areas for staff.**

**1226.8.6.1 Staff toilet(s).** Refer to Section 1226.4.17.1.

**1226.8.6.2 Storage for employees.** Refer to Section 1226.4.17.2.

## **CHRONIC DIALYSIS CLINICS**

**1226.9 CHRONIC DIALYSIS CLINICS.** Chronic dialysis clinics and outpatient clinical services of a hospital providing

services equivalent to a chronic dialysis clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

### **1226.9.1 Examination and treatment rooms.**

**1226.9.1.1 Examination room(s).** An examination room with a handwashing fixture shall be provided with a minimum clear floor area of 100 square feet (9.29 m<sup>2</sup>).

**1226.9.1.2 Treatment room(s).** When provided, refer to Section 1224.4.4.1.

**1226.9.1.3 Individual patient treatment areas.** Individual patient treatment areas shall contain at least 80 square feet (7.44 m<sup>2</sup>). There shall be at least a 4-foot (1219 mm) space around and between beds and/or lounge chairs. In addition, the following shall be provided:

1. **Location.** The treatment area may be an open area and shall be separate from administrative area and outpatient waiting room.
2. **Privacy.** An open unit shall be designed to provide visual privacy for each patient.

**1226.9.1.4 Reception.** Refer to Section 1226.4.16.1.1.

**1226.9.1.5 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.9.1.6 Bloodborne infection isolation room.** A minimum of one bloodborne infection isolation room of at least 120 square feet (11.15 m<sup>2</sup>) of clear floor space shall be provided for patients. This room shall contain a counter and handwashing fixture.

**1226.9.1.7 Airborne infection isolation exam/treatment room.** When provided, refer to Section 1224.4.4.1.1.

**1226.9.1.8 Home training.** When provided in the unit, a private treatment area of at least 120 square feet (11.15 m<sup>2</sup>) shall be provided for patients who are being trained to use dialysis equipment at home. This room shall contain counter, handwashing fixture(s), and a separate drain for fluid disposal.

### **1226.9.2 Support areas for examination and treatment rooms.**

**1226.9.2.1 Administrative center or nurse station.** Administrative center or nurse station shall be located within the dialysis treatment area and designed to provide visual observation of all patient stations. In addition, refer to Section 1226.4.13.1 for nurses' station(s) requirements.

**1226.9.2.1.1 Handwashing fixtures.** Handwashing fixture(s) shall be located convenient to the administrative center or nurses' station and patient treatment areas. There shall be at least one handwashing fixture serving no more than four stations. These shall be uniformly distributed to provide equal access from each patient station. Refer to Section 1224.3 for the definition of a handwashing fixture.

**1226.9.2.2 Medication station.** Refer to Section 1226.4.13.2.

**1226.9.2.3 Clean utility room.** Refer to Section 1226.4.13.3.

**1226.9.2.4 Soiled workroom or soiled linen holding.** Refer to Section 1226.4.13.4.

**1226.9.2.5 Housekeeping room.** Provide adjacent to and for the exclusive use of the unit. In addition, In addition, this room shall be a minimum floor area of 15 square feet and shall include the following:

1. Service sink or floor receptor
2. Supply storage
3. Housekeeping equipment storage

**1226.9.2.6 Nourishment room.** When provided, refer to Section 1226.4.13.7.

**1226.9.2.7 Sterilization facilities.** When provided, refer to Section 1226.4.13.6.

**1226.9.3 Administrative services.** Provide office and clinical work space including the following:

**1226.9.3.1 Medical records storage.** Refer to Section 1226.4.16.2.1.

**1226.9.3.2 Equipment and supply storage.** Refer to Section 1226.4.16.2.2.

**1226.9.4 Support areas for patients.**

**1226.9.4.1 Patient toilet room(s).** Provide patient toilet room(s) directly accessible from treatment area. The toilet shall be equipped with bedpan flushing attachment(s). Refer to Section 1226.4.14.1.

**1226.9.4.2 Patient storage.** Provide space for storage of patient clothing and personal items.

**1226.9.4.3 Specimen collection facilities.** When provided, refer to Section 1224.4.4.2.

**1226.9.5 General support services and facilities.**

**1226.9.5.1 Garbage, solid waste, medical waste and trash storage.** Refer to Section 1226.4.9.

**1226.9.5.2 Areas for off-site laundry services.** Refer to Section 1226.4.15.1.

**1226.9.5.3 Reprocessing room.** When dialyzers are reused, a reprocessing room is required and sized to perform the functions required and include one-way flow of materials from soiled to clean with provisions for a refrigerator for temporary storage of dialyzer, decontamination/cleaning areas, sinks, processors, computer processors and label printers, packaging area, dialyzer storage and disinfectants storage.

**1226.9.5.4 Repair room.** When required, an equipment repair and breakdown room shall be equipped with a handwashing fixture, deep service sink, work counter and storage cabinet. Provide water supply and drain connection for testing machines.

**1226.9.5.5 Mixing room.** Each facility using a central batch delivery system shall provide, either on the premises or through written arrangements, individual delivery systems for the treatment of any patient requiring special dialysis solutions. The mixing room shall also include a sink, storage space and holding tanks.

**1226.9.5.6 Water treatment room.** The water treatment equipment shall be located in an enclosed room.

**1226.9.6 Support areas for staff.**

**1226.9.6.1 Staff toilet(s).** Refer to Section 1226.4.17.1.

**1226.9.6.2 Storage for employees.** Refer to Section 1226.4.17.2.

## REHABILITATION CLINICS

**1226.10 REHABILITATION CLINICS.** Rehabilitation clinics and outpatient clinical services of a hospital providing services equivalent to a rehabilitation clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

## SUPPORT AREAS FOR THERAPY SERVICES.

**1226.10.1 Support area for patients.**

**1226.10.1.1 Patient toilet room(s).** Refer to Section 1226.4.14.1.

**1226.10.2 General support.**

**1226.10.2.1 Garbage.** Refer to Section 1226.4.9.

**1226.10.2.2 Housekeeping.** Refer to Section 1224.4.15.

**1226.10.2.3 Areas for off-site laundry services.** Refer to Section 1226.4.15.1.

**1226.10.3 Public and administrative.**

**1226.10.3.1 Public area.**

**1226.10.3.1.1 Reception.** Refer to Section 1226.4.16.1.1.

**1226.10.3.1.2 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.10.3.1.3 Toilet(s).** Refer to Section 1224.4.4.5.

**1226.10.3.1.4 Drinking fountain.** Refer to Section 1224.4.4.5.

**1226.10.3.1.5 Telephone.** Refer to Section 1224.4.4.5.

**1226.10.3.2 Administrative services.** Provide office and clinical work space including the following:

**1226.10.3.2.1 Medical records storage.** Refer to Section 1226.4.16.2.1.

**1226.10.3.2.2 Equipment and supply storage.** Refer to Section 1226.4.16.2.2.

**1226.10.4. Support areas for staff.**

**1226.10.4.1 Staff toilet(s).** Refer to Section 1226.4.17.1.

**1226.10.4.2 Storage for employees.** Refer to Section 1226.4.17.2.

## REHABILITATION THERAPY SERVICE SPACES.

**1226.10.5 Physical therapy service space.** A physical therapy service space shall be provided. The service space shall comply with the following provisions:

1. **Individual treatment area(s).** Refer to Section 1224.35.2, Item 1.
2. **Handwashing fixture(s).** Refer to Section 1224.35.2, Item 2.
3. **Exercise area.** Refer to Section 1224.35.2, Item 3.
4. **Clean linen and towel storage.** Refer to Section 1224.35.2, Item 4.
5. **Storage for equipment and supplies.** Refer to Section 1224.35.2, Item 5.
6. **Separate storage for soiled linen, towels and supplies.** Refer to Section 1224.35.2, Item 6.

**1226.10.6 Occupational therapy service space.** When an occupational therapy service is provided, the service space shall comply with following provisions:

1. **Work areas and counters.** Refer to Section 1224.35.3, Item 1.
2. **Handwashing fixture(s).** Refer to Section 1224.35.3, Item 2.
3. **Storage for supplies and equipment.** Refer to Section 1224.35.3, Item 3.
4. **Area for teaching daily living activities.** Refer to Section 1224.35.3, Item 4.

**1226.10.7 Speech pathology and/or audiology service space.** When speech pathology and/ or audiology service(s) is provided, the service space shall comply with the following provisions:

1. **Interview, consultation and treatment space.** Refer to Section 1224.35.4, Item 1.
2. **Waiting area.** Refer to Section 1224.35.4, Item 2.
3. **Handwashing fixture.** Refer to Section 1224.35.4, Item 3.
4. **Testing unit.** If an audiology service is provided. Refer to Section 1224.35.4, Item 4.

## ALTERNATIVE BIRTHING CLINICS

**1226.11 ALTERNATIVE BIRTHING CLINICS.** Alternative birthing clinics and outpatient clinical services of a hospital providing services equivalent to alternative birthing clinics shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section:

### 1226.11.1 Birthing service space.

**1226.11.1.1 Birthing room.** A birthing room shall have a minimum clear floor area of 200 square feet (18.58 square meters), including the newborn care area. A birthing room shall have a minimum clear dimension of 12 feet (3658 mm). The maximum number of beds per room shall be one.

**1226.11.1.2 Location.** Birthing rooms shall be located out of the path of unrelated traffic and under direct supervision of the facility staff.

**1226.11.1.3 Nurse call system.** A nurse call system shall be located in the birthing room which will alert the nearest continually staffed administrative center or nurses' station. Refer to Section 1224.4.6.5 for requirements.

**1226.11.1.4 Hand-washing stations.** A handwashing fixture, as defined in Section 1224.3, shall be located within or directly outside the room. If the fixture is located within the room, the fixture may be screened or within openable casework.

**1226.11.1.5 Lighting.** Lighting capable of 1076 lux (100 footcandles) at working surfaces shall be provided. Dimmer switches may be used.

**1226.11.1.6 Window.** Each birthing room shall have an outside window. Refer to Sections 1224.4.9.4 and 1224.4.9.5.

**1226.11.1.7 Privacy.** Windows or doors within a normal sightline that would permit observation into the room shall be arranged or draped, as necessary, for mother and newborn privacy.

**1226.11.1.8 Newborn care area.** When provided, a separate newborn care area shall be provided that is in addition to the birthing room.

**1226.11.1.9 Examination room.** When provided, the examination room shall meet the requirements of Section 1224.4.4.

### 1226.11.2 Support areas for birthing services.

**1226.11.2.1 Administrative center or nurse station.** Refer to Section 1226.4.13.1.

**1226.11.2.2 Medication station.** Refer to Section 1226.4.13.2.

**1226.11.2.3 Clean utility room.** Refer to Section 1226.4.13.3.

**1226.11.2.4 Soiled utility or soiled holding room.** Refer to Section 1226.4.13.4.

**1226.11.2.5 Crash cart space.** Space for storing crash cart shall be provided.

**1226.11.2.6 Clean-up room.** Each birthing room shall have access to a clean-up room with a handwashing fixture and work space which is separate from any sterilizing facilities. The clean-up room shall provide 24 square feet (2.23 m<sup>2</sup>) per birthing room up to eight rooms, with no dimensions less than 6 feet (1829 mm).

**1226.11.2.7 Ice-making equipment.** Each facility shall have equipment to provide ice for treatments and nourishment. Ice-making equipment shall be permitted in the clean utility or the nourishment room/area. Ice intended for human consumption shall be provided in the nourishment station and shall be served from self-dispensing ice-makers.

**1226.11.2.8 Nourishment room or area.** When provided, refer to Section 1226.4.13.7.

**1226.11.2.9 Medical gas outlets.** When provided, oxygen and suction capabilities may be portable or piped.

**1226.11.3 Support areas for mother and newborn.**

**1226.11.3.1 Patient toilet room(s).** Each birthing room shall have direct access to a private toilet room with lavatory, shower or tub and nurse call system. Facilities for cleaning bedpans shall be provided in the toilet room.

**1226.11.4 General support services and facilities.**

**1226.11.4.1 Housekeeping room.** Refer to Section 1224.4.15.

**1226.11.4.2 Garbage, solid waste, medical waste and trash storage.** Refer to Section 1226.4.9.

**1226.11.4.3 Areas for off-site laundry services.** Refer to Section 1226.4.15.1.

**1226.11.5 Public and administrative areas.**

**1226.11.5.1 Public area.**

**1226.11.5.1.1 Reception.** Refer to Section 1226.4.16.1.1.

**1226.11.5.1.2 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.11.5.1.3 Public toilet(s).** Refer to Section 1224.4.5.

**1226.11.5.1.4 Public telephone.** Refer to Section 1224.4.5.

**1226.11.5.1.5 Drinking fountain.** Refer to Section 1224.4.5.

**1226.11.5.2 Administrative services.**

**1226.11.5.2.1 Medical records storage.** Refer to Section 1226.4.16.2.1.

**1226.11.5.2.2 Equipment and supply storage.** Refer to 1226.4.16.2.2.

**1226.11.6 Support areas for staff.**

**1226.11.6.1 Staff toilet(s).** Refer to Section 1226.4.17.1.

**1226.11.6.2 Storage for employees.** Refer to Section 1226.4.17.2.

**1226.11.6.3 Staff lounge.** Refer to Section 1226.4.17.3.

**1226.11.6.4 Staff clothing change area.** When provided, a changing room with shower shall be provided for staff to change into work attire.

**PSYCHOLOGY CLINICS**

**1226.12 PSYCHOLOGY CLINICS.** Psychology clinics and outpatient clinical services of a hospital providing services equivalent to a psychology clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

Psychology clinics shall provide at least an interview room, consulting room and group therapy room.

**1226.12.1 Public and administrative area.**

**1226.12.1.1 Public area.**

**1226.12.1.1.1 Reception.** Refer to Section 1226.4.16.1.1.

**1226.12.1.1.2 Outpatient waiting room.** Refer to Section 1224.4.5.

**1226.12.1.1.3 Public toilet(s).** Refer to Section 1224.4.5.

**1226.12.1.1.4 Drinking fountain.** Refer to Section 1224.4.5.

**1226.12.1.1.5 Public telephone.** Refer to Section 1224.4.5.

**1226.12.1.2 Administrative Area.**

**1226.12.1.2.1 Medical Records storage.** Refer to Section 1226.4.16.2.1.

**1226.12.1.2.2 Equipment and supply storage.** Refer to Section 1226.4.16.2.2.

**SECTION 1227 [OSHPD 4]  
CORRECTIONAL TREATMENT CENTERS\**

**1227.1 Scope.** The provisions of this section shall apply to correctional treatment centers.

**1227.2 Application.** New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, and California Fire Code (Parts 3, 4, 5, and 9 of Title 24) and this section.

**1227.3 Definitions.**

**BASIC SERVICES** for correctional treatment centers are those services required for licensure as a correctional treatment center, including medical, surgical, psychiatrist, psychologist, nursing, pharmacy and dietary. See "Optional services."

**HAND WASHING FIXTURE** is a special application sink having a water supply spout mounted so the discharge point is at least 5 inches (127 mm) above the fixture rim and equipped with hot and cold supply controls not requiring direct contact of the hands for operation. The fixture cannot be equipped with an aerator and wrist or elbow blade handles. Gooseneck spouts shall not be used in correctional treatment centers.

**LICENSING AGENCY** is the Department of Health Services.

**OPTIONAL SERVICES** are inpatient or outpatient services which are not required to be provided by law or regulation for licensure. An optional service, when provided, must accommodate the provisions of this section. See "Basic services."

**OUTPATIENT SERVICE** is an organizational unit of the correctional treatment center which provides nonemergency health care services to patients.

#### 1227.4 GENERAL CONSTRUCTION.

**1227.4.1 Services/systems and utilities.** Correctional treatment centers shall comply with this section.

**1227.4.1.1 Oxygen, vacuum and medical air.** Correctional treatment centers shall comply with the requirements of Section 1224.4.6 wherever applicable.

**1227.4.2 Service spaces.** Spaces for dietary, laundry, morgue, ambulance entrance, receiving areas, power plants, mechanical equipment, incinerator, garbage can cleaning, automobile parking and storage areas for garbage, trash and medical gases shall be located and constructed to minimize noise, steam, odors and hazards in patient care areas and bedrooms.

**1227.4.3 Treatment spaces.** Radiology, laboratory, pharmacy and physical therapy spaces shall not be located in nursing units, surgical units, perinatal units, nursery areas, central sterilization rooms, food service areas, power plants, mechanical equipment rooms, maintenance shops, general storage, laundry, employees' dressing or housekeeping facilities.

**1227.4.4 Treatment or exam room.** If a treatment room or an exam room is provided, it shall have a minimum area of 80 square feet (7.43 m<sup>2</sup>), the least dimension of which shall be 8 feet (2438 mm).

#### 1227.5 CORRIDORS.

**1227.5.1 Width.** The minimum width of corridors shall be 8 feet (2438 mm).

**Exception:** Patient-care corridors in correctional treatment centers for psychiatric care of patients who are not bedridden shall have a minimum clear and unobstructed width of 6 feet (1829 mm). For the purpose of this section, bedridden patients shall be defined as patients confined to beds who would be transported or evacuated in beds or litters.

**1227.5.2 Service corridors width.** Service corridors with anticipated light traffic volume for nonpatient use may be reduced to a width of 5 feet (1524 mm) if approved by the enforcing agency.

**Exception:** Corridors in administrative and business areas may be reduced to a width of 44 inches (1118 mm).

**1227.5.3 Handrails.** Corridors for patient traffic in areas providing skilled nursing, intermediate, care or rehabilitation services shall be furnished with a handrail on both sides at a height not less than 30 inches (762 mm) or greater than 36 inches (914 mm).

**1227.5.4 Connections.** Corridor systems shall connect all patient rooms and essential services.

#### 1227.6 DOORS AND DOOR OPENINGS.

**1227.6.1 Toilet room doors.** Doors to toilet rooms shall have an opening of not less than 32 inches (813 mm) clear in width and shall be equipped with hardware which will permit the door to swing outward or in a manner to negate the need to push against a patient who may have collapsed within the toilet room.

**1227.6.2 Pocket doors.** Pocket sliding doors are not permitted.

**Exception:** Doors not serving as exit doors from administration areas.

**1227.6.3 Door view windows.** Doors to patient bedrooms shall be provided with a view window with a minimum area of 288 square inches (0.186 square meters). Window sill height shall not be higher than 42 inches (1067 mm) from the floor.

#### 1227.7 WINDOWS AND SCREENS.

**1227.7.1 Natural light.** Rooms approved for the housing of patients shall be provided with natural light by means of glazed openings.

**1227.7.2 Screens.** When windows are operable, they shall be provided with insect screens of 16 meshes to the inch.

**1227.7.3 Light and ventilation.** All portions of a building used by patients, personnel or other persons shall be provided with artificial light and a mechanically operated ventilating system as specified in the California Electrical Code and the California Mechanical Code.

**1227.7.4 Patient viewing windows.** Each patient bedroom shall be provided with viewing windows from the corridor to allow full and unobstructed visual observation of the patient.

#### 1227.8 CEILING HEIGHTS.

**1227.8.1 Minimum height.** The minimum height of ceilings shall be 8 feet (2438 mm).

**Exception:** Closet, toilet rooms and bathroom minimum ceiling heights shall not be less than 7 feet (2134 mm).

**1227.8.2 Minimum height with fixed ceiling equipment.** Rooms containing ceiling-mounted, major fixed equipment or ceiling-mounted surgical light fixtures shall have ceiling heights to accommodate the equipment or fixtures and their normal movement.

#### 1227.9 INTERIOR FINISHES

##### 1227.9.1 Floor finishes.

**1227.9.1.1 Floor finishes.** Shall be smooth, waterproof and durable.

**Exception:** Upon written appropriate documented request, the enforcing agency may grant approval of the installation of carpet. See Table 1224.1.

**1227.9.1.2 Resilient flooring.** If used in toilet and bathing rooms, shall be continuous and extend upward onto the walls at least 5 inches (127 mm).

##### 1227.9.2 Wall bases.

**1227.9.2.1 Materials and installation.** The material and textures of bases and the installation thereof shall be such as to minimize dust-catching surfaces, moisture, infiltration and the harboring of vermin.

**Exception:** In locations where carpet is permitted as a floor finish material, the use of carpeted base (coved or strip base) up to a maximum height of 5 inches (127 mm) is also permissible.

**1227.9.2.2 Wood bases.** Wood bases are prohibited except in administration departments and other offices described in Section 1227.16.

**Exceptions:** Wall bases in kitchens, operating rooms, delivery rooms, emergency operating rooms, cast rooms, special procedure rooms and other areas which are subject to wet cleaning methods shall be made integral and coved with the floor, and constructed without voids at the intersection of floor and wall surfaces.

**1227.9.3 Walls.** Interior wall finishes shall be smooth, washable and durable.

**1227.9.4 Ceilings.** Ceiling finishes shall be in compliance with Table 1224.1.

**Exceptions:** Walls and ceiling finish requirements do not apply to boiler rooms, mechanical equipment rooms, administration departments, other offices, enclosed stairways, maintenance shops and similar spaces.

#### 1227.10 ELEVATORS.

**1227.10.1 Patient elevators** shall have minimum inside platform dimensions of 5 feet by 8 feet (1524 mm by 2438 mm) and a minimum clear door opening of 4 feet, 0 inches (1118 mm).

**1227.10.2 Passenger elevators** shall have minimum inside platform dimensions of 4 feet, 8 inches by 7 feet, 4 inches (1422 mm by 2236 mm).

**1227.10.3 Buildings over one story in height with accommodations or services for patients on floors without grade level entrance** shall provide at least one passenger or patient elevator.

**1227.10.4 If bed patients are accommodated on one or more floors, other than the main entrance floor or where operating rooms or delivery rooms are above or below the main entrance floor,** at least one patient elevator shall be provided.

**1227.10.5 At least one patient elevator and one service elevator** shall be provided in correctional treatment centers with a capacity of 60 to 149 beds on floors other than the main entrance floor.

**1227.10.6 At least one patient elevator, one passenger elevator and one service elevator** shall be provided in hospitals with a capacity of 150 or more beds on floors other than the main entrance floor.

**1227.10.7 If elevators in the correctional institution meet the above size requirements and are easily accessible,** the elevators need not be duplicated in the correctional treatment centers.

**1227.11 GARBAGE-SOLID WASTE AND TRASH STORAGE.** Rooms or screening enclosures shall be provided for the washing and cleaning of garbage containers and for the storage of garbage, trash, and other solid wastes. Such rooms or screening enclosures shall include the following:

1. A concrete floor with a curb and with a drain connected to the sewer.

2. Steam or hot-water and cold-water supply.

3. A minimum floor area of .5 square feet (0.046 m<sup>2</sup>) per bed, but not less than 25 square feet (2.32 m<sup>2</sup>), the least dimension of which shall be 4 feet (1219 mm).

4. A method of limiting access to the material except by authorized persons.

#### BASIC SERVICES

#### 1227.12 NURSING SERVICE SPACE.

**1227.12.1 Patient bedrooms.** Patients shall be accommodated only in rooms with the following minimum floor area, exclusive of toilet rooms, wardrobes, entrance vestibules, and fixed furnishings or equipment.

1. Single-patient rooms: 110 square feet (10.22 m<sup>2</sup>).
2. Multi-patient rooms: 80 square feet (7.43 m<sup>2</sup>) per bed.

**1227.12.2 Distance.** A minimum distance of 3 feet (914 mm) shall be provided between beds and 4 feet (1219 mm) between the foot of beds and walls or fixed objects in multipatient rooms, and 3 feet (914 mm) in single-patient rooms.

**1227.12.3 Airborne infection isolation rooms.** Single rooms shall be provided for the isolation of patients with airborne communicable disease at a ratio of one room for each 35 beds, or major fraction thereof. At least one airborne infection isolation room shall be provided. Airborne infection isolation rooms shall be labeled with the words "Airborne Infection Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom.

**1227.12.3.1 Alternates.** Alternate designs for modifications to isolation rooms in operation prior to the effective date of this section may be utilized when it can be demonstrated that the alternate design meets performance requirements, without compromising any health or life-safety requirement.

**1227.12.3.2 Anteroom doors.** Airborne infection isolation room(s) shall have self-closing and latching devices on all anteroom doors.

**1227.12.3.3 Anteroom.** A separate anteroom shall be provided between the airborne infection isolation room and the corridor, which shall constitute the primary entrance to the negative pressure isolation room. This anteroom shall have a handwashing fixture, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the isolation room and means to allow for airflow from the anteroom into the negative pressure isolation room. Doors shall be aligned to allow large equipment to be wheeled into the airborne infection isolation room unless a secondary door complying with Section 1227.12.3.4 is provided. One anteroom may serve no more than two airborne infection isolation rooms.

**1227.12.3.4 Secondary entry.** When a secondary entry is provided directly from the corridor to the negative-pressure isolation room, secondary doors shall be pro-

vided with locking devices which are readily openable from the room side and which are readily openable by the facility staff on the other side. When key locks are used on isolation rooms, keys shall be located at the nurses' station in a prominent readily accessible location.

**1227.12.3.5 Adjoining toilet facilities.** Each isolation room shall have its own toilet room facilities with an emergency nurse call system, a lavatory, a shower providing a seat or a space for a shower chair and a toilet equipped with a bedpan flushing attachment with a vacuum breaker.

**1227.12.3.6 Sealed-tight room.** Airborne infection isolation room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

**1227.12.4 Protective environment rooms.** Protective environment rooms for the protection of certain immunosuppressed patients may be provided by the facility. Protective environment rooms shall be labeled "Protective Environment Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom.

**1227.12.4.1 Anteroom doors.** Airborne infection isolation room(s) shall have self-closing and latching devices on all anteroom doors.

**1227.12.4.2 Anteroom.** A separate anteroom shall be provided between the protective environment room and the corridor or adjoining space which shall constitute the only entrance to the protective environment isolation room. This anteroom shall have a handwashing fixture, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the positive-pressure isolation room. There shall be means to allow for airflow from the protective environment room into the anteroom. Anteroom doors shall be aligned so that large equipment can be wheeled into the isolation room. One anteroom may serve no more than one protective environment room.

**Exception:** Alternate designs for protective environment rooms, without individual anterooms, may be approved by the enforcement agency when it can be demonstrated that the alternate design meets the requirements of the California Mechanical Code and does not compromise or alter any health or fire-protection component, assembly or system.

**1227.12.4.3 Toilet room(s).** Adjoining toilet room facilities shall meet the requirements of Section 1227.12.3.5.

**1227.12.4.4 Sealed-tight room.** Protective environment room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

**1227.12.5 Identification.** Each patient room shall be labeled with an identification number, letter or combination of the two.

## **1227.12.6 Observation rooms.**

**1227.12.6.1 Observation rooms.** Provide for disturbed/special patients at a ratio of one room for each 30 beds or major fraction thereof. At least one observation room shall be provided in each nursing service unit.

**1227.12.6.2 Viewing windows.** Observation rooms shall be provided with viewing windows to allow full and unobstructed visual observation of the patient. They shall be located near the nurses' station and toilet room facilities.

**1227.12.6.3 Appendages and equipment.** Rooms shall be free of appendages and equipment which could facilitate suicide or self-mutilation.

**1227.12.7 Nurses' station.** A nurses' station shall be provided within each nursing unit.

**1227.12.7.1 Components.** Nurses' stations shall be provided with a cabinet, a desk, space for records, a bulletin board, a telephone, and a specifically designated and lockable and illuminated medicine storage compartment, and a handwashing fixture. If a separate medicine room is provided, it shall have a lockable door and a medicine sink. This sink cannot replace the required nurses' station handwashing fixture.

**1227.12.7.2 Size.** Nurses' stations serving 25 or less beds shall have a minimum floor area of 100 square feet (9.29 m<sup>2</sup>). Nurses' stations servicing more than 25 beds shall have a minimum floor area of 125 square feet (11.6 m<sup>2</sup>). The minimum dimension of any nurses' station shall not be less than 8 feet (2438 mm).

**1227.12.7.3 Distance.** The distance between the nurses' station entrance and the center of the doorway of the most remote patient bedroom shall not exceed 90 linear feet (27432 mm).

**Exception:** This section does not preclude designs based on primary nursing concepts incorporating more than one single nursing station of less than 100 square feet (9.29 m<sup>2</sup>) each and an additional work space or station for unit clerk/receptionist junctions.

**1227.12.7.4 Correctional officer.** A separate space for the correctional officer may adjoin the nurses' station but shall not be included in the minimum square footage requirement for a nurses' station.

**1227.12.8 Utility rooms.** Utility rooms shall be provided in each nursing unit. Clean utility rooms shall contain a work counter, hand warming fixture and storage facilities unless the room is used only for storage and holding as part of a system for distribution of clean and sterile supplies, in which case the work counter and handwashing fixture may be omitted. Soiled utility rooms shall contain a handwashing fixture, work counter, waste receptacles and linen hampers unless the room is used only for the temporary holding of soiled materials, in which case the handwashing fixture and work counter may be omitted.

**1227.12.8.1 Size.** Utility rooms shall be designed for the separation of clean and soiled areas and provide

not less than 100 square feet (9.29 m<sup>2</sup>). Alternatively, separate clean and soiled utility rooms of not less than 50 square feet (4.65 m<sup>2</sup>) each may be provided. Additional square footage accommodating Section 1227.18 shall be provided if utility rooms also include linen and supply storage space.

**1227.12.8.2 Aisle widths.** Minimum aisle widths in utility rooms shall be 4 feet (1219 mm).

**1227.12.9 Treatment and exam room.** If a treatment room or an exam room is provided, it shall have a minimum area of 80 square feet (7.43 m<sup>2</sup>), the least dimension of which shall be 8 feet (2438 mm).

**1227.12.10 Toilet and bath facilities.** Separate toilet room facilities shall be provided for the use of patients and personnel.

**1227.12.10.1 Bathroom facilities.** Provide for patients in the nursing unit in at least the following ratios:

Bathtubs or showers 1:12 patients

(Minimum one bathtub on each floor providing skilled nursing or intermediate care services)

Lavatories 1:8 patients

(Fixtures shall be equipped without aerators and may have conventional controls. Gooseneck spouts shall not be used)

Toilets 1:6 patients

Fixtures serving individual patient rooms shall not be considered as meeting the required ratios for bedrooms not served by individual adjoining toilet rooms or bathrooms.

Changes in these ratios for wards or units in which bed patients only are to be cared for may be permitted by the enforcing agency.

**1227.12.11 Patient/nurse call system.** A patient/nurse call system accommodating Section 517-123, California Electrical Code, shall be provided.

### 1227.13 PHARMACEUTICAL SERVICE SPACE.

**1227.13.1 Licensed pharmacy.** A licensed pharmacy shall be provided and shall comply with the provisions of Section 1250.

**1227.13.1.1 Entrance and waiting.** If the pharmacy dispenses directly to inmates from the correctional institution, an entrance and a waiting area separate from the inpatient areas shall be provided.

### 1227.14 DIETETIC SERVICE SPACE.

**1227.14.1 Dietetic service space.** The dietetic service space shall accommodate the provisions of Section 1225.5.

**Exceptions:**

1. The dietetic service in the correctional institution is found acceptable to the licensing agency.

2. Contractual arrangement for dietetic services with another health facility acceptable to the licensing agency.

**1227.15 OFFICES.** Office spaces shall be provided for the provisions of nursing, physician, psychiatric and psychological services.

**1227.15.1 Consultation/interviews.** Consultation/interview rooms shall be provided.

**1227.15.2 Conference/group activities.** Separate rooms or spaces shall be provided for conferences and group activities.

**Exception:** If conference room or space is available to the correctional treatment facility staff in the correctional institution, this room or space need not be duplicated.

### 1227.16 ADMINISTRATION SPACE.

**1227.16.1 Administration.** An administration area shall be provided which shall provide for the following functions:

1. Waiting area.
2. Offices for the administrator and clerical personnel.

**1227.16.2 Records.** Spaces shall be provided which accommodate the following functions:

1. Work area for sorting and recording records, for either paper or electronic media.
2. Secure storage area for medical records, for either paper or electronic media.

### 1227.17 CENTRAL STERILE SUPPLY.

**1227.17.1 Minimum requirements.** A central supply and sterilizing area shall be provided. Rooms and spaces shall accommodate the following services and equipment:

1. Soiled work area. A receiving and gross cleaning area which shall contain workspace and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled material.
2. Clean work area. A clean work area which shall contain work space, and equipment for sterilizing medical and surgical equipment and supplies.
3. Sterilizing space.

**Exception:** Items 1 through 3 do not apply to facilities with contractual arrangements for outside autoclaving and sterilizing services.

4. Storage. Space for sterile supplies and unsterile supplies.

**1227.17.2 Sterilizers and autoclaves.** All sterilizers and autoclaves which emit steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

**Exception:** Small instrument sterilizers.



### 1227.18 STORAGE.

**1227.18.1 General storage.** Hospitals shall provide combined general and specialized storage space in accordance with the following:

1–10 beds	120 square feet (11.15 m <sup>2</sup> ) minimum
11–100 beds	12 square feet (1.11 m <sup>2</sup> ) per bed
over 100 beds	1,200 square feet (111.48 m <sup>2</sup> ) plus 5 square feet (0.46 m <sup>2</sup> ) per bed for each bed over 100

**1227.18.2 Specialized storage.** Specialized storage spaces shall include the following:

1. **Linen.** Separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m<sup>2</sup>) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m<sup>2</sup>), and may be within the soiled utility room.
2. **Supply.** One supply storage space having a minimum area of 15 square feet (1.39 m<sup>2</sup>) shall be provided in each nursing unit. Supply storage may be within the clean utility room used only as part of a system for distributing clean and sterile supplies.
3. **Wheelchairs.** A room or space shall be provided in each nursing unit for wheelchairs and stretchers. The wheelchair and stretcher space shall have a minimum area of 15 square feet (1.39 m<sup>2</sup>).
4. **Storage.** Sterile and unsterile supplies shall be stored separately.

### 1227.19 EMPLOYEE DRESSING ROOMS AND LOCKERS.

**1227.19.1 Minimum facilities.** Correctional treatment centers shall provide the following:

1. **Dressing rooms.** Separate dressing rooms for male and female personnel with lockers, lavatory and toilet(s).

**Exception:** If provided for the correctional treatment center staff in adjacent correctional institutions, dressing rooms and lockers need not be duplicated.

### 1227.20 HOUSEKEEPING ROOM.

**1227.20.1** A securely lockable housekeeping room with service sink and supply storage spaces shall be provided in each nursing unit.

#### OPTIONAL SERVICES

**1227.21 SERVICE SPACES.** Service spaces, such as laboratory, radiology and any other services approved by the licensing agency, shall comply with the applicable space requirements of Sections 1224 and 1225. Service spaces shall also comply with applicable provisions of the California Building Standards Administrative Code (Part 1).

**1227.22 OUTPATIENT SERVICES.** The following shall be provided or made available to a outpatient service space.

**1227.22.1 Waiting.** Waiting area(s) shall be provided with access to toilet room facilities and a drinking fountain both meeting the requirements of Sections 1231.3.1, 1231.3.2 and 1231.3.3.

**1227.22.1.1 Holding cell.** If a temporary holding cell or room is used for this purpose, it shall comply with Section 1231.2.2.

**Exception:** The minimum floor area shall be 80 square feet (7.43 m<sup>2</sup>).

### 1227.23 24-HOUR MENTAL HEALTH CARE SERVICES.

**1227.23.1 Program/dining space.** Provide within the Correctional Treatment Center for use by mental health treatment program patients, as is consistent with security requirements. Program/dining space shall be provided with a minimum floor area of 30 square feet (2.79 m<sup>2</sup>) per patient served at a given time.

**1227.23.2 Mental health treatment.** Correctional treatment centers providing a mental health treatment program shall include one safety room for every 30 mental health treatment program beds or fraction thereof, and one observation room providing direct observation of every portion of the room for every 15 mental health beds or fraction thereof. At least one safety room and one observation room shall be provided.

**1227.23.3 Safety rooms.** Safety rooms shall be constructed so as to provide video camera observation capability. Safety rooms shall comply with the design criteria requirements of Section 1231.2.5 for a safety cell.

### SECTION 1228 Reserved

### SECTION 1229 Reserved

### SECTION 1230 [BSCC] MINIMUM STANDARDS FOR JUVENILE FACILITIES

#### 1230.1 Design criteria for required spaces.

**1230.1.1 Reception/intake admission.** In each juvenile hall, space used for the reception of minors pending admission to juvenile hall shall have the following space and equipment:

1. Weapons lockers as specified in Section 1230.2.9;
2. A secure room for the confinement of minors pending admission to juvenile hall as specified in Section 1230.1.2;

In each juvenile hall, camp and ranch, space used for the reception of minors pending admission to these facilities shall have the following space and equipment:

3. Access to a shower;
4. A secure vault or storage space for minors, valuables;

5. Telephones accessible to minors; and
6. Access to hot and cold running water for staff use.

**1230.1.2 Locked holding room.** A locked holding room shall:

1. Contain a minimum of 15 square feet (1.4 m<sup>2</sup>) of floor area per youth;
2. Provide no less than 45 square feet (4.2 m<sup>2</sup>) of floor space and have a clear ceiling height of 8 feet (2438 mm) or more;
3. Contain seating to accommodate all youth as specified in Section 1230.2.8;
4. Be equipped with a toilet, wash basin and drinking fountain as specified in Section 1230.2, unless a procedure is in effect to give the youth access to a toilet, wash basin and drinking fountain;
5. Maximize visual supervision of youth by staff; and
6. Have an outward swinging or lateral sliding door.

**1230.1.3 Natural light.** Visual access to natural light shall be provided in locked sleeping rooms, single occupancy sleeping rooms, double occupancy sleeping rooms, dormitories and day rooms. Natural light may be provided by, but is not limited to, skylights or windows in dayrooms, windows in adjacent exterior exercise areas, and in sleeping rooms and/or dormitories.

**1230.1.4 Corridors.** Corridors in living units shall be at least 8 feet (2438 mm) wide.

**Exception:** Where room doors are staggered, or if rooms are located on only one side, corridors shall be at least 6 feet (1829 mm) wide.

**1230.1.5 Living unit.** A living unit shall be a self-contained unit containing locked sleeping rooms, single and double occupancy sleeping rooms, or dormitories, day-room space, toilet, wash basins, drinking fountains and showers commensurate to the number of youth housed. A living unit shall not be divided in a way that hinders direct access, supervision, immediate intervention or other action if needed. In juvenile halls, the number of youth housed in a living unit shall not exceed 30.

**1230.1.6 Locked sleeping rooms.** Locked sleeping rooms shall be equipped with an individual or combination toilet, wash basin and drinking fountain. Doors to locked sleeping rooms shall swing outward or slide laterally.

**1230.1.7 Single occupancy sleeping rooms.** Single occupancy sleeping rooms shall provide the following:

1. A minimum of 70 square feet (1.78 m<sup>2</sup>) of floor area;
2. A minimum clear ceiling height of 8 feet (2438 mm); and,
3. The door into this room shall swing outward or slide laterally and be provided with a view panel, a minimum of 144 square inches (92,903 mm<sup>2</sup>), constructed of security glazing.

**1230.1.8 Double occupancy sleeping rooms.** Double occupancy sleeping rooms shall provide the following:

1. A minimum of 100 square feet (9.3 m<sup>2</sup>) of floor area;
2. A minimum clear ceiling height of 8 feet (2438 mm) and a minimum width of 7 feet (2134 mm); and,
3. The door into this room shall swing outward or slide laterally and be provided with a view panel, a minimum of 144 square inches (92,903 mm<sup>2</sup>), constructed of security glazing.

**1230.1.9 Dormitories.** Dormitories shall provide the following:

1. A minimum of 50 square feet (4.6 m<sup>2</sup>) of floor area per minor with the minimum size of a dormitory being 200 square feet (18.6 m<sup>2</sup>) of floor area and a minimum 8-foot (2438 mm) clear ceiling height;
2. Designed for no fewer than four minors;
3. Dormitories in juvenile halls shall be designed for no more than 30 minors;
4. Camps shall conform to Items 1 and 2.

**1230.1.10 Dayrooms.** Dayrooms shall contain 35 square feet (3.3 m<sup>2</sup>) of floor area per minor. Access must be provided to toilets, wash basins, drinking fountains and showers as specified in Section 1230.2.

**1230.1.11 Physical activity and recreation areas.** Indoor / outdoor physical activity and recreation areas shall be designed as follows:

1. Facility capacity	Minimum indoor outdoor recreation space
40 or less	9,000 square feet (836 m <sup>2</sup> )
41 to 274	225 square feet (21 m <sup>2</sup> ) per minor up to 61,650 square feet (5727 m <sup>2</sup> )
275 or more	61,650 square feet (5727 m <sup>2</sup> ), plus 145 square feet (13.47 m <sup>2</sup> ) for each minor beyond 274 [up to a maximum of 87,120 square feet (8093 m <sup>2</sup> )]

- 1.1. At least one quarter of the dedicated indoor/ outdoor space shall be a paved or like surface.
- 1.2. The required recreation area shall contain no single dimension less than 40 feet (12.2 m).
2. A portion of the dedicated space for physical activity and recreation shall be out-of-doors and be of sufficient size and equipped in such a manner to allow compliance with Title 15, Section 1371, which requires at least one hour per day of outdoor activity for each detained minor.
3. Lighting of outdoor recreation areas shall be provided to allow for evening activities and to provide security.
4. Access must be provided to a toilet, wash basin and drinking fountain as specified in Section 1230.2.

**TABLE 1230A  
REQUIRED SPACES AND EQUIPMENT IN JUVENILE FACILITIES**

SECTION NUMBERS	REGULATION	HALLS	CAMPS	SPJH
1230.1.1	Reception/intake admission	X		
1230.1.2	Locked holding rooms	X	X <sup>1</sup>	
1230.1.3	Natural light	X	X	X
1230.1.4	Corridors	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
1230.1.5	Living units	X		
1230.1.6	Locked sleeping rooms	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
1230.1.7	Single occupancy sleeping rooms	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
1230.1.8	Double occupancy sleeping rooms	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
1230.1.9	Dormitories	X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
1230.1.10	Day rooms	X	X	X
1230.1.11	Physical activity and recreation areas	X	X	
1230.1.12	Academic classrooms	X	X	
1230.1.13	Safety rooms	X <sup>1</sup>		
1230.1.14	Medical examination rooms	X	X	
1230.1.15	Pharmaceutical storage	X	X	X
1230.1.16	Dining areas	X	X	
1230.1.17	Visiting space	X	X	X
1230.1.18	Institutional storage	X	X	X
1230.1.19	Personal storage	X	X	X
1230.1.20	Safety equipment storage	X	X	X
1230.1.21	Janitorial closet	X	X	X
1230.1.22	Audio monitoring system	X	X	X
1230.1.23	Emergency power	X	X	X
1230.1.24	Confidential interview rooms	X	X	X
1230.1.25	Special-purpose juvenile halls	X		
1230.1.26	Court holding rooms for minors*	X <sup>1</sup>		
1230.2.1	Toilets/urinals	X	X	X
1230.2.2	Wash basins	X	X	X
1230.2.3	Drinking fountains	X	X	X
1230.2.4	Showers	X	X	X
1230.2.5	Beds	X	X	X
1230.2.6	Lighting	X	X	X
1230.2.7	Padding	X <sup>1</sup>		
1230.2.8	Seating	X	X	X
1230.2.9	Weapons lockers	X	X <sup>1</sup>	X

Key:

Halls = Juvenile halls.

Camps = Camps, ranches, forestry camps or boot camps.

SPJH = Special-purpose juvenile halls.

\* = For minors in jail, minors in temporary custody in a law enforcement facility and minors in court holding facilities, see Sections 1520, 1540 and 1560 of Title 15, respectively.

X = Regulation is applicable for all juvenile facilities.

X<sup>1</sup> = Regulation is applicable for halls, camps and special-purpose juvenile halls dependent on operational characteristics of the facility.

**1230.1.12 Academic classrooms.** There shall be dedicated classroom space for every juvenile in every facility. The primary purpose for the academic classroom shall be for education. Each academic classroom shall contain a minimum of 160 square feet (14.9 m<sup>2</sup>) of floor space for the teachers' desk and work area and a minimum of 28 square feet (2.6 m<sup>2</sup>) of floor space per minor. A communication system shall be provided in each classroom to allow for immediate response to emergencies. The classroom shall be designed for a maximum of 20 minors.

**1230.1.13 Safety room.** A safety room shall:

1. Contain a minimum of 63 square feet (5.9 m<sup>2</sup>) of floor area and a minimum clear ceiling height of 8 feet (2438 mm);
2. Be limited to one minor;
3. Be padded as specified in Section 1230.2.7;
4. Provide one or more vertical view panels constructed of security glazing. These view panels shall be no more than 4 inches (102 mm) wide nor less

than 24 inches (610 mm) long, which shall provide a view of the entire room;

5. Provide an audio monitoring system as specified in Section 1230.1.22;
6. Provide access to a toilet, wash basin and drinking fountain outside the room as specified in Section 1230.2; and
7. Be equipped with a variable intensity, security-type lighting fixture with controls located outside the room.
8. Any wall or ceiling-mounted devices must be designed to prohibit access to the minor occupant.

**1230.1.14 Medical examination room.** There must be a minimum of one suitably equipped medical examination room in every juvenile facility. Medical examination rooms shall provide the following:

1. Space for carrying out routine medical examinations and emergency care and used for no other purpose;
2. Privacy for minors;
3. Lockable storage space for medical supplies;
4. Not less than 144 square feet (13.4 m<sup>2</sup>) of floor space with no single dimension less than 7 feet (2134 mm);
5. Hot and cold running water; and
6. Smooth, nonporous, washable surfaces.

**1230.1.15 Pharmaceutical storage.** Provide lockable storage space for medical supplies and pharmaceutical preparations as specified by Title 15, Section 1438.

**1230.1.16 Dining areas.** Dining areas in juvenile facilities shall contain a minimum of 15 square feet (1.4 m<sup>2</sup>) of floor space and sufficient tables and seating for each person being fed. Persons being fed include minors, staff and visitors. Dining areas shall not contain toilets or showers in the same room without appropriate visual barrier.

**1230.1.17 Visiting space.** Space shall be provided in all juvenile facilities for visiting.

**1230.1.18 Institutional storage.** One or more storage rooms shall be provided to accommodate a minimum of 80 cubic feet (2.3 m<sup>3</sup>) of storage space per minor. Items to be stored shall be institutional clothing, bedding, supplies and activity equipment.

**1230.1.19 Personal storage.** Each minor in a juvenile facility shall be provided with a minimum of 9 cubic feet (0.25 m<sup>3</sup>) of secure storage space for personal clothing and belongings.

**1230.1.20 Safety equipment storage.** In all juvenile facilities, a secure area shall be provided for the storage of safety equipment, such as fire extinguishers, self-contained breathing apparatus, wire and bar cutters, emergency lights, etc.

**1230.1.21 Janitorial closet.** In all juvenile facilities, at least one securely lockable janitorial closet, containing a mop sink and sufficient area for the storage of cleaning

implements, must be provided within the security area of the facility.

**1230.1.22 Audio monitoring system.** In safety rooms, locked holding rooms, locked sleeping rooms, single and double occupancy rooms and dormitories, there must be an audio monitoring system capable of actuation by the minor that alerts personnel.

**1230.1.23 Emergency power.** There shall be a source of emergency power in all juvenile facilities capable of providing minimal lighting in all living units, activities areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems (Title 24, Part 2, Chapter 27). Such an emergency power source shall conform to the requirements specified in Title, 24, Part 3, Article 700, California Electrical Code, California Code of Regulations.

**1230.1.24 Confidential interview room.** Confidential interview rooms shall contain a minimum of 60 square feet (5.6 m<sup>2</sup>) of floor area. In juvenile halls there shall be a minimum of one suitably furnished interview room for each 30 minors. In camps there shall be a minimum of one suitably furnished interview room for each facility. This interview room shall provide for confidential consultations with minors.

**1230.1.25 Special-purpose juvenile halls.** Special-purpose juvenile halls shall conform to all minimum standards for juvenile facilities contained in this section with the following exceptions:

1. Physical activity and recreation areas as specified in Section 1230.1.11;
2. Academic classrooms as specified in Section 1230.1.12;
3. Medical examination room as specified in Section 1230.1.14; and,
4. Dining areas as specified in Section 1230.1.16.

**1230.1.26 Court holding room for minors.** A court holding room shall:

1. Contain a minimum of 10 square feet (0.93 m<sup>2</sup>) of floor area per minor;
2. Be limited to no more than 16 minors;
3. Provide no less than 40 square feet (3.7 m<sup>2</sup>) of floor area and have clear ceiling height of 8 feet (2438 mm) or more;
4. Contain seating to accommodate all minors as specified in Section 1230.2.8;
5. Contain a toilet, wash basin and drinking fountain as specified in Section 1230.2; and,
6. Maximize visual supervision of minors by staff.

**1230.1.27 Program and activity areas.** Camp and ranch facilities shall include adequate space for specific programs in addition to recreation and exercise areas.

## 1230.2 Design criteria for furnishings and equipment.

**1230.2.1 Toilet/urinals.** In living units, toilets must be available in a ratio to minors as follows:

1. Juvenile halls 1:6;
2. Camps 1:10; and
3. Locked holding rooms 1:8;

One toilet and one urinal may be substituted for every 15 males.

**Note:** Toilet areas shall provide privacy for the minor without mitigating staff's ability to supervise.

**1230.2.2 Wash basins.** In living units, wash basins must be available in a ratio to minors as follows:

1. Juvenile halls 1:6;
2. Camps 1:10; and
3. Locked holding rooms 1:8;

Wash basins must be provided with hot and cold or tempered water.

**1230.2.3 Drinking fountains.** In living areas and indoor and outdoor recreation areas, drinking fountains must be accessible to minors and to staff.

1. The drinking fountain bubbler shall be on an angle which prevents waste water from flowing over the drinking bubbler; and,
2. The water flow shall be actuated by a mechanical means.

**1230.2.4 Showers.** In living units, showers shall be available to all minors on a ratio of at least one shower or bathtub to every six minors. Showers shall be provided with tempered water.

**Note:** Shower areas shall provide privacy for the minor without mitigating staff's ability to supervise.

**1230.2.5 Beds.** Beds shall be at least 30 inches (762 mm) wide and 76 inches (1930 mm) long and be of the solid bottom type or constructed of concrete. Beds shall be at least 12 inches (305 mm) off the floor and spaced no less than 36 inches (914 mm) apart. Bunk beds must have no less than 33 inches vertically between the solid bottoms. In secure facilities, the bunks shall be securely anchored and flushed against the floor and/or wall.

**1230.2.6 Lighting.** Lighting in locked sleeping rooms, single occupancy rooms, double occupancy rooms, dormitories, day rooms and activity areas shall provide not less than 20 footcandles (216 lux) of illumination at desk level. Night lighting is required in these areas to provide good visibility for supervision and be conducive to sleep.

**1230.2.7 Padding.** In safety rooms, padding shall cover the entire floor, door, walls and everything on the walls to a clear height of 8 feet (2438 mm). Benches or platforms are not to be placed on the floor of this room.

All padded rooms must be equipped with a tamper-resistant fire sprinkler as approved by the State Fire Marshal. All padding must be:

1. Approved for use by the State Fire Marshal;

2. Nonporous to facilitate cleaning;
3. At least 1/2 inch (12.7 mm) thick;
4. Of a unitary or laminated construction to prevent its destruction by teeth, hand tearing or small metal objects;
5. Firmly bonded to all padded surfaces to prevent tearing or ripping; and,
6. Without any exposed seams susceptible to tearing or ripping.

**1230.2.8 Seating.** Seating shall be designed to the level of security. When bench seating is used, 18 inches (457 mm) of bench is seating for one person.

**1230.2.9 Weapons lockers.** Weapons lockers are required in all secure juvenile facilities and shall be located outside the secure area of the facility. Weapons lockers shall be equipped with individual compartments, each with an individual locking device.

**1230.2.10 Security glazing.** Security glazing shall comply with the minimum requirements of one of the following test standards: American Society for Testing and Materials, ASTM F 1233-98, Class III glass, or; California Department of Corrections, CDC 860-94d, Class C glass or; H.P. White Laboratory, Inc., HPW-TP-0500.02, Forced Entry Level III.

## SECTION 1231 [BSCC] LOCAL DETENTION

### 1231.1 Definitions.

**BOARD OF STATE & COMMUNITY CORRECTIONS** means the Board of State & Community Corrections, which acts by and through its executive officer, deputy directors and field representatives.

**LIVING AREAS** means those areas of a facility utilized for the day-to-day housing and activities of inmates. These areas do not include special-use cells such as sobering, safety and holding or staging cells normally located in receiving areas.

**LOCAL DETENTION FACILITY** is any city, county, city and county, or regional jail, camp, court holding facility or other correctional facility, whether publicly or privately operated, and court holding facility used for the confinement of adults or of both adults and minors, but does not include that portion of a facility for the confinement of both adults and minors which is devoted only to the confinement of minors. The types of local detention facilities are as follows:

**Court holding facility** means a local detention facility constructed within a court building after January 1, 1978, used for the confinement of persons solely for the purpose of a court appearance for a period not to exceed 12 hours.

**Temporary holding facility** means a local detention facility constructed after January 1, 1978, used for the confinement of persons for 24 hours or less pending release, transfer to another facility or appearance in court.

**Type I facility** means a local detention facility used for the detention of persons usually pending arraignment for not more than 96 hours, excluding holidays, after booking. Such a Type I facility may also detain persons on court order either for their own safe-keeping or sentenced to a city jail as an inmate worker, and may house inmate workers sentenced to the county jail provided such placement in the facility is made on a voluntary basis on the part of the inmate. As used in this section, an inmate worker is defined as a person assigned to perform designated tasks outside of his or her cell or dormitory, pursuant to the written policy of the facility, for a minimum of four hours each day on a five-day scheduled work week.

**TYPE II FACILITY** means a local detention facility used for the detention of persons pending arraignment, after arraignment, during trial and upon a sentence of commitment.

**TYPE III FACILITY** means a local detention facility used only for the detention of convicted and sentenced persons.

**TYPE IV FACILITY** means a local detention facility or portion thereof designated for the housing of inmates eligible, under Penal Code Section 1208, for work/education furlough and/or other programs involving inmate access into the community.

**RATED CAPACITY** means the number of inmate occupants for which a facility's single-and double-occupancy cells or dormitories, except those dedicated for medical or disciplinary isolation housing, were planned and designed in conformity to the standards and requirements contained herein and in Title 15, C.C.R.

#### **1231.2 Design criteria for required spaces.**

**1231.2.1 Reception and booking.** Facilities where booking and housing occur shall have the following space and equipment:

1. Weapons locker as specified in Section 1231.3.12.
2. A cell or room for the confinement of inmates pending their booking, complying with Section 1231.2.2.
3. A sobering cell as described in Section 1231.2.4 if intoxicated, inmates who may pose a danger to themselves or others are held. For those facilities that accept male and female intoxicated inmates two sobering cells shall be provided.
4. Access to a shower within the secure portion of the facility.
5. Provide access to a secure vault or storage space for inmate valuables.
6. A safety cell or cells as described in Section 1231.2.5 if the program statement identifies the need for such a cell.
7. Telephones which are accessible to the inmates.
8. Unobstructed access to hot and cold running water for staff use.

**1231.2.2 Temporary holding cell or room.** A temporary holding cell or room shall:

1. Contain a minimum of 10 square feet (0.93 m<sup>2</sup>) of floor area per inmate;
2. Be limited to no more than 16 inmates;
3. Be no smaller than 40 square feet (3.7 m<sup>2</sup>) and have a clear ceiling height of 8 feet (2438 mm) or more;
4. Contain seating to accommodate all inmates as required in Section 1231.3;
5. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3;
6. Maximize visual supervision of inmates by staff; and
7. When located in a temporary holding facility, the cell or room shall be equipped with a bunk if inmates are to be held longer than 12 hours.

**1231.2.3 Temporary staging cell or room.** A temporary staging cell or room shall:

1. Be constructed for the purpose of holding inmates who have been classified and segregated in accordance with Sections 1050 and 1053 of Title 15, Division 1, California Code of Regulations.
2. Be limited to holding inmates up to four hours.
3. Be limited to no more than 80 inmates.
4. Contain a minimum of 10 square feet (0.93 m<sup>2</sup>) of floor area per inmate and a clear ceiling height of 8 feet (2438 mm) or more.
5. Be no smaller than 160 square feet (14.9 m<sup>2</sup>).
6. Contain seating to accommodate all inmates as required in Section 1231.3.
7. Contain toilet, wash basin and drinking fountain as specified in Section 1231.3.
8. Maximize visual supervision of inmates by staff.

**1231.2.4 Sobering cell.** A sobering cell shall:

1. Contain a minimum of 20 square feet (1.9 m<sup>2</sup>) of floor area per inmate;
2. Be limited to eight inmates;
3. Be no smaller than 60 square feet (5.6 m<sup>2</sup>) and have a clear ceiling height of 8 feet (2438 mm) or more;
4. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3;
5. Have padded partitions located next to toilet fixture in such a manner that they provide support to the user;
6. Maximize visual supervision of inmates by staff;
7. Be padded on the floor as specified in Section 1231.3; and,
8. Have accessible a shower in the secure portion of the facility.

**TABLE 1231A  
REQUIRED SPACES AND EQUIPMENT IN JUVENILE FACILITIES**

	TYPE I	TYPE II	TYPE III	TYPE IV	COURT HOLDING	TEMPORARY HOLDING
Reception/booking	x	x	*	*		*
Temporary holding cells or room	x	x	*	*	x	x
Detoxification cell	*	x				
Safety cell	*	*				
Single-occupancy cell	x	x	*			
Dormitories	*	x	x	x		
Day room	*	x	x			
Exercise area		x	x	x <sup>1</sup>		
Shower area/delousing room	x	x				*
Program/multipurpose space		x	x	x		
Medical exam room <sup>2</sup>		x	x			
Pharmaceutical storage space	x	x	x	x		*
Medical care housing		*	*			
Hair care space		x	x			
Commissary <sup>3</sup>			x	x <sup>3</sup>		
Dining facility <sup>4</sup>	*	x	x	*		
Visiting space	x	x	x	x		
Attorney interview rooms	x	x	x		x	x
Confidential interview rooms		x	*			
Safety equipment storage	x	x <sup>2</sup>	x	x	x	x
Janitor closet	x	x	x	x	x	x
Storage rooms	x	x <sup>5</sup>	x	x	x	x
Audio/video-monitoring systems	x	x	x <sup>6</sup>	*	x	x
Laundry facility		x		x <sup>7</sup>		
Fire-detection alarm system	x	x	x	x	x	x
Emergency	x	x	x	x	x	x

x - Required.

\* - Required when program statement identifies need.

1. Not required if community recreation facilities are available.

2. Not required if the inmate population is less than 25.

3. Not required if community access is available.

4. Not required if meals are served in day room.

5. Must be securely lockable and located within the security area.

6. Required in areas housing prisoners of higher than minimum security.

7. Not required if community access is permitted.

**1231.2.5 Safety cell.** A safety cell shall:

1. Contain a minimum of 48 square feet (4.5 m<sup>2</sup>) of floor area with no one floor dimension being less than 6 feet (1829 mm) and a clear ceiling height of 8 feet (2438 mm) or more;
2. Be limited to one inmate;
3. Contain a flushing ring toilet, capable of accepting solid waste, mounted flush with the floor, the controls for which must be located outside of the cell;
4. Be padded as specified in Section 1231.3;
5. Be equipped with a variable intensity, security-type lighting fixture which is inaccessible to the inmate

occupant, control of which is located outside of the cell;

6. Provide one or more vertical view panels not more than 4 inches (102 mm) wide nor less than 24 inches (610 mm) long which shall provide a view of the entire room;
7. Provide a food pass with lockable shutter, no more than 4 inches (102 mm) high, and located between 26 inches (660 mm) and 32 inches (813 mm) as measured from the bottom of the food pass to the floor; and,
8. Any wall or ceiling mounted devices must be inaccessible to the inmate occupant.

**1231.2.6 Single-occupancy cells.** Single-occupancy cells shall:

1. Have a maximum capacity of one inmate;
2. Contain a minimum of 60 square feet (5.6 m<sup>2</sup>) of floor area in Type I facilities and 70 square feet (6.5 m<sup>2</sup>) of floor area in Type II and Type III facilities;
3. Have a minimum clear ceiling height of 8 feet (2438 mm) and a minimum width of 6 feet (1829 mm);
4. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3; and
5. Contain a bunk, desk and seat as specified in Section 1231.3.

**Exception:** A Type I facility does not require a desk and seat.

**1231.2.7 Double-occupancy cells.** Double-occupancy cells shall:

1. Have a maximum capacity of two inmates;
2. Contain a minimum of 60 square feet (5.6 m<sup>2</sup>) of floor area in Type I facilities and 70 square feet (6.5 m<sup>2</sup>) of floor area in Type II and Type III facilities;
3. Have a minimum clear ceiling height of 8 feet (2438 mm) and a minimum width of 6 feet (1829 mm);
4. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3; and
5. Contain two bunks, and at least one desk and seat as specified in Section 1231.3.

**Exception:** A Type I facility does not require a desk and seat.

**1231.2.8 Dormitories.** Dormitories shall:

1. Contain a minimum of 50 square feet (4.7 m<sup>2</sup>) of floor area per inmate for a single-bed unit; a minimum of 70 square feet (7 m<sup>2</sup>) for a double-bed unit; and a minimum of 90 square feet (9.3 m<sup>2</sup>) for triple-bed unit and have a minimum ceiling height of 8 feet (2438 mm);
2. Be designed for no more than 64 inmates and no fewer than four inmates;
3. Provide access to water closets separate from the wash basin and drinking fountains as specified in Section 1231.3; and
4. In other than Type I facilities, provide storage space for personal items and clothing for each occupant.

**1231.2.9 Dayrooms.**

Dayrooms or dayroom space shall:

1. Contain 35 square feet (3.3 m<sup>2</sup>) of floor area per inmate in width in front of cells/rooms;
2. Contain tables and seating to accommodate the maximum number of inmates;
3. Provide access to water closets, wash basins and drinking fountains as specified in Section 1231.3;
4. Provide access to a shower or showers as specified in Section 1231.3; and

5. Be provided to all inmates in Type II and Type III facilities (except those housed in special-use cells) and to inmate workers in Type I facilities.

Dayroom space as described in this section may be a part of a single occupancy cell used for administrative segregation or a dormitory, in which case the floor area of the cell or a dormitory must be increased by the square footage required for the dayroom.

**1231.2.10 Exercise area.** An outdoor exercise area or areas must be provided in every Type II and Type III facility. The minimum clear height must be 15 feet (4572 mm) and the minimum number of square feet of surface area will be computed by multiplying 80 percent of maximum rated population by 50 square feet (4.7 m<sup>2</sup>) and dividing the result by the number of one-hour exercise periods per day.

The exercise area must contain or provide free access to a toilet, wash basin, and drinking fountain as provided in Section 1231.3.

There must be at least one exercise area of not less than 600 square feet (55.7 m<sup>2</sup>). The design shall facilitate security and supervision appropriate to the level of custody.

Type IV facilities shall have an outdoor recreation area or access to community recreation facilities.

**1231.2.11 Correctional program/multipurpose space.** An area for correctional programming must be provided in every Type II and Type III facility. The program area and furnishings shall be designed to meet the needs specified by the facility's program statement.

Type IV facilities shall have multipurpose space for games and activities, dining, visiting, TV meetings and quiet space for study and reading, such that activities do not conflict with each other.

**1231.2.12 Medical examination room.** There must be a minimum of one suitably equipped medical examination room in every facility which provides on-site health care. The examination room shall be designed in consultation with the responsible physician/health authority. Such a medical examination room shall:

1. Be located within the security area and provide for privacy of the inmates;
2. Provide not less than 100 square feet (9.3 m<sup>2</sup>) of floor space with no single dimension less than 7 feet (2134 mm);
3. Provide hot and cold running water;
4. Provide lockable storage for medical supplies; and
5. Any room where medical procedures are provided must be equipped with hot and cold running water.

**1231.2.13 Pharmaceutical storage space.** Provide lockable storage space for medical supplies and pharmaceutical preparations as referenced by Title 15, California Code of Regulations, Section 1216.

**1231.2.14 Medical care housing.** There shall be some means to provide medical care and housing of ill and/or infirm inmates. When the program statement for a Type II



or Type III facility indicates that medical care housing is needed, such housing must provide lockable storage space for medical instruments and must be located within the security area of the facility accessible to both female and male inmates, but not in the living area of either. The medical care housing unit shall be designed in consultation with the health authority. Medical/mental health areas may contain other than single occupancy cells.

If negative pressure isolation rooms are being planned, they shall be designed to recognized industry standards.

**1231.2.15 Reserved.**

**1231.2.16 Commissary.** In all Type II, III and IV facilities, except where community access is available, there shall be provisions made for inmates to purchase items (such as candy, toilet articles, stationery supplies, books, newspapers and magazines, etc.). An area shall be provided for the secure storage of the stock for such inmate canteen items.

**1231.2.17 Dining facilities.** In all Type II, III and IV facilities which serve meals, dining areas shall be provided which will allow groups of inmates to dine together. Such dining areas shall not contain toilets, wash basins or showers in the same room without appropriate visual barrier. Wherever the facility contains a central dining room or rooms, it shall contain a minimum of 15 square feet (1.4 m<sup>2</sup>) of floor space and sufficient tables and seating for each inmate being fed.

**1231.2.18 Visiting space.** Space shall be provided in all Types I, II, III and IV facilities for visiting.

**1231.2.19 Safety equipment storage.** A secure area shall be provided for the storage of safety equipment such as fire extinguishers, self-contained breathing apparatus, wire and barcutters, emergency lights, etc.

**1231.2.20 Janitors' closet.** In Type II facilities, at least one securely lockable janitors' closet with sufficient area for the storage of cleaning implements and supplies must be provided within the security areas of the facility. A mop sink shall also be available within the security area of the facility. In court holding, temporary holding, Types I, III and IV facilities, the closet need not be in the security area.

**1231.2.21 Storage rooms.** One or more storage rooms shall be provided to accommodate a minimum of 80 cubic feet (2.3 m<sup>3</sup>) of storage area per inmate for inmate clothing and personal property, institutional clothing, bedding and supplies. Court holding, temporary holding and Type I facilities may be excluded from the storage space requirement for personal and institutional clothing unless clothing is issued.

**1231.2.22 Audio monitoring system.** In court holding, temporary holding, Type I, Type II and Type II facilities there shall be an inmate- or sound-actuated audio monitoring system in temporary holding cells or rooms, temporary staging cells or rooms, sobering cells, safety cells, single and double occupancy cells, dormitories, day-rooms, exercise areas and correctional program/multipur-

pose space, which is capable of alerting personnel who can respond immediately.

**1231.2.23 Laundry facilities.** In Type IV facilities, provision shall be made for washing and drying personal clothing by machines, either in the facility or in the community, if access is permitted for same.

**1231.2.24 Emergency power.** There shall be a source of emergency power in all detention facilities capable of providing minimal lighting in all housing units, activities areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems. Such an emergency power source shall conform to the requirements specified in Title 24, Part 3, Article 700, California Electrical Code, California Code of Regulations.

**1231.2.25 Confidential interview rooms.** There must be a minimum of one suitably furnished interview room for confidential interviews in every facility which provides on-site health care. The interview room shall be designed in consultation with responsible custodial staff and health care staff. Such an interview room shall:

1. Be located within the security area accessible to both female and male inmates; and
2. Provide not less than 70 square feet (6.5 m<sup>2</sup>) of floor space with no single dimension less than 6 feet (1829 mm).

**1231.2.26 Attorney interview space.** All facilities except Type IV facilities shall include attorney interview areas which provide for confidential consultation with inmates.

**Exception:** The design of court holding and temporary holding facilities shall include the following required spaces from Sections 1231.2.2, 1231.2.19, 1231.2.20, 1231.2.21, 1231.2.22, 1231.2.24 and 1231.2.26.

**1231.3 Design criteria for furnishings and equipment.** Furnishings and equipment shall be as follows:

**1231.3.1 Toilets/urinals.**

1. Toilets/urinals must be provided in single-occupancy cells and double-occupancy cells.
2. In dormitories, toilets/urinals must be provided in a ratio to inmates of 1:10.
3. Toilets/urinals must be accessible to the occupants of day-rooms and exercise areas.
4. In temporary holding cells and temporary staging cells toilets/urinals must be provided in a ratio to inmates of 1:16.
5. In sobering cells toilets/urinals must be provided in a ratio to inmates of 1:8.
6. One urinal or 2 feet (610 mm) of urinal trough may be substituted for each toilet up to one third of the total number of toilets required, except in those facilities or portions thereof used for females.

**Note:** Toilet areas shall provide modesty for inmates with staff being able to visually supervise.

**1231.3.2 Wash basins.**

1. Wash basins must be provided in single occupancy cells and double occupancy cells.
2. In dormitories, wash basins must be provided in a ratio to inmates of 1:10.
3. Wash basins must be accessible to the occupants of day-rooms and exercise areas.
4. In temporary holding cells and temporary staging cells, wash basins must be provided in a ratio to inmates of 1:16.
5. In sobering cells, wash basins must be provided in a ratio to inmates of 1:8.
6. Wash basins must be provided with hot and cold or tempered water.
7. Two feet (610 mm) of wash basin trough may be substituted for each basin required.

**1231.3.3 Drinking fountains.** There must be a minimum of one drinking fountain in every single-occupancy cell, double-occupancy cell, dormitory, temporary holding cell, temporary staging cell, sobering cell, and be accessible to the occupants of day rooms and exercise areas. Additional drinking fountains shall be located in other areas of the facility so that drinking water will be available to inmates and staff. Such drinking fountains must meet the following minimum health requirements:

1. The drinking fountain bubbler shall be on an angle which prevents waste water from flowing over the drinking fountain bubbler.
2. Water flow shall be actuated by mechanical means.

**1231.3.4 Showers** must be available to all inmates on a ratio of at least one shower to every 20 inmates or fraction thereof and must provide hot and cold water or tempered water. Shower stalls/shower areas must be designed and constructed of materials which are impervious to water and soap so they may be easily cleaned.

**Note.** Shower areas shall provide modesty for inmates with staff being able to visually supervise.

**1231.3.5 Beds** must be elevated off the floor, have a solid bottom, and a sleeping surface of at least 30 inches (762 mm) wide and 76 inches (1930 mm) long. Multiple beds must have a minimum of 21 inches (533 mm) between bed pans. Except in minimum security areas, beds must be securely fastened to the floor or the wall.

**1231.3.6 Lighting.** Lighting in housing units, dayrooms and activity areas must be sufficient to permit easy reading by a person with normal vision, and shall not be less than 20 footcandles (215.2 lux) at desk level and in the grooming area. Lighting shall be centrally controlled and/or occupant controlled in housing cells or rooms. Night lighting in these areas shall be sufficient to give good visibility for purposes of supervision. In minimum-security areas, lighting may be supplied by ordinary lighting fixtures, and in areas of higher security, light fixtures must be of secure design.

**1231.3.7 Windows.** In housing areas of higher than minimum security, exterior windows which are constantly accessible to inmates for escape must be designed and constructed so that if broken out, the net area accessible for escape is no greater than 5 inches (127 mm) in one dimension.

**1231.3.8 Cell padding.** In sobering cells, the floor and partition shall be padded. In safety cells, padding must cover the entire floor, doors, and walls and everything on them to a clear height of 8 feet (2438 mm).

All such padded cells must be equipped with a tamper-resistant fire sprinkler as approved by the State Fire Marshal. All padding must be:

1. Approved for use by the State Fire Marshal;
2. Nonporous to facilitate cleaning;
3. At least 1/2-inch (12.7 mm) thick;
4. Of a unitary or laminated construction to prevent its destruction by teeth, hand tearing or small metal objects;
5. Firmly bonded to all padded surfaces to prevent tearing or ripping; and
6. Without any exposed seams susceptible to tearing or ripping.

**1231.3.9 Mirrors.** A mirror of a material appropriate to the level of security must be provided near each wash basin specified in these regulations.

**1231.3.10 Seating.** In temporary holding and temporary staging cells, seating must be securely fixed to the floor and/or wall. When bench seating is used, 18 inches (457 mm) of bench is seating for one person.

**1231.3.11 Table/seat.** In single- and double-occupancy cells, a table and seat for the purpose of writing and dining shall be provided.

**Exception:** A Type I facility does not require a table and a seat.

**1231.3.12 Weapons locker.** A secure weapons locker shall be located outside the security perimeter of the facility. Such weapons lockers shall be equipped with individual compartments, each with an individual locking device. Weapons lockers are required in temporary and court holding facilities and in all facilities of higher than minimum security.

**Exception:** The design of court holding and temporary holding facilities shall include the design criteria for furnishings and equipment from Sections 1231.3.1, 1231.3.2, 1231.3.3, 1231.3.6, 1231.3.10 and 1231.3.12.

**1231.4 Enclosure of vertical openings.** Elevator shafts, vent shafts and other vertical openings shall be enclosed, and the enclosure shall be as set forth in Chapter 7.

**1231.5 Fire-extinguishing systems.** Automatic fire-extinguishing systems, standpipes and basement pipe inlets shall be installed when and as required by Chapter 9.

**1231.6 Existing Group I occupancies.** Existing buildings housing existing protective social-care homes or facilities

established prior to the effective date of these regulations may have their use continued if they conform, or are made to conform, to the following provisions.

**1231.6.1 Use of floors.** The use of floor levels in buildings of Type III, IV or V nonfire-rated construction may be as follows:

*Nonambulatory—first floor only;*

*Ambulatory—not higher than the third-floor level, provided walls and partitions are constructed of materials equal in fire-resistive quality to that of wood lath and plaster in good repair and all walls are firestopped at each floor level.*

**1231.6.2 Enclosure of exits and vertical openings.** Except for two-story structures housing ambulatory guests, all interior stairs shall be enclosed in accordance with Chapter 10. In lieu of stairway enclosures, floor separations or smoke barriers may be provided in such a manner that fire and smoke will not spread rapidly to floors above or otherwise impair exit facilities. In these instances, floor separations or smoke barriers shall have a fire resistance equal to not less than 1/2-inch (12.7 mm) gypsum wall board on each side of wood studs with openings protected by not less than a 1 3/4-inch (44 mm) solid bonded wood-core door of the self-closing type. All other vertical openings shall be enclosed in accordance with the provisions of Chapter 7.

**1231.6.3 Exit access.** Each floor or portion thereof of buildings used for the housing of existing protective social-care homes or facilities shall have access to not less than two exits in such a manner as to furnish egress from the building or structure in the event of an emergency substantially equivalent to the provisions of Chapter 10.

**1231.6.4 Corridor openings.** Openings from rooms to interior corridors shall be protected by not less than 1 3/4-inch (44 mm) solid-bonded wood-core doors. Transoms and other similar openings shall be sealed with materials equivalent to existing corridor wall construction.

**1231.6.5 Interior wall and ceiling finishes** shall conform to the requirements for a Group R, Division 1 occupancy as specified in Chapter 8.

**1231.6.6 Automatic sprinkler systems** shall be installed in existing protective social-care occupancies in accordance with the provisions of Chapter 9.

**1231.6.7 Fire alarm systems.** Automatic fire alarm systems shall be installed in existing protective social-care homes or facilities in accordance with the provisions of Chapter 9.

**Exception:** When an approved automatic sprinkler system conforming to Chapter 9 is installed, a separate fire alarm system as specified in this subsection need not be provided.

## SECTION 1232 Reserved

## SECTION 1233 Reserved

## SECTION 1234 Reserved

## SECTION 1235 [DPH] SANITARY CONTROL OF SHELLFISH (PLANTS AND OPERATIONS)

**1235.1 Culling plants.** Culling plants shall be located in areas free from unsanitary conditions and faulty sewage disposal. They shall be provided with an ample supply of water under adequate pressure from a source approved by the Department of Health Services for the purpose of hosing down floor and benches and cleaning the shellfish. Floors and premises shall be kept in a clean and sanitary condition.

**1235.2 Plant arrangement.** Unless shellfish are shucked directly into packing containers with no further processing, the shucking and packing processes shall be done in separate rooms. There shall be installed in the partition between the two rooms a delivery window through which the shucked stock is passed to the packing room. Provision shall be made for storing the employees' outer garments, aprons, gloves, etc., in a separate room.

**Note:** In special instances where shucking is done on a small scale for local retail sales, shucking and packing may be permitted in a single room if approved by the Department of Health Services. This single room and all operations shall conform to all requirements of these regulations except that of separate shucking and packing rooms. "Limited" certificates shall be issued in these instances and all containers of shucked shellfish shall be clearly labeled or marked with words "Limited Certificate" and the appropriate certificate number.

**1235.3 Floors.** The floors of all rooms in which shellfish are stored, shucked, washed, packed or otherwise processed shall be constructed of concrete or other equally impervious material, graded to drain quickly, free from cracks or uneven surfaces that might interfere with proper cleaning or drainage, and maintained in clean and satisfactory condition.

**1235.4 Walls and ceilings.** Walls and ceilings shall be maintained in a smooth, clean, washable, light-colored conditions. They shall be impervious to moisture and shall be kept in good repair. Walls contiguous to benches shall, to a height of 2 feet (610 mm) above the bench top, be of smooth concrete, metal or equally nonabsorbent material.

**1235.5 Screening.** The plant shall have all openings effectively screened, unless other effective means are provided to prevent the entrance of flies and other insects.

**1235.6 Light.** Ample light to work by shall be provided in all working rooms. A light intensity of not less than 10 footcandles (108 lux) shall be maintained on all working surfaces when workers are at their working positions.

**1235.7 Ventilation.** Adequate ventilation shall be provided to prevent condensation on ceilings or other surfaces.

**1235.8 Toilet facilities.** Every shellfish culling, shucking, packing or repacking plant shall be provided with clean and adequate toilet facilities conveniently located. No toilet room shall be used for the storage of garments, food products, containers or equipment. Construction and maintenance of toilets shall comply with all local and state regulations.

**1235.9 Handwashing facilities.** An adequate number of lavatories shall be provided at locations convenient to toilet rooms and shellfish handling operations, including running hot and cold water, soap and individual disposal towels. The use of a common towel is prohibited. All employees shall wash their hands thoroughly with running water and soap on beginning work and after each visit to the toilet. Signs to this effect shall be posted in conspicuous places in the plant and in the toilet rooms.

**1235.10 Sewers and drains.** Sewage and other liquid wastes shall be discharged into public sewers wherever possible. Where private sewage or waste disposal systems must be utilized, they shall be constructed in accordance with state and local regulations pertaining thereto. Plant waste systems shall be properly trapped and vented. Waste liquids shall be disposed of in a manner that will not adversely affect the quality of the water in which shellfish are grown or stored. Waste lines from washing machines shall have suitable protection against the possibility of sewage or wastes entering these machines.

**1235.11 Water supply.** Shucking, packing or repacking plants shall be provided with an ample supply of water under adequate pressure from a source approved by the Department of Health Services. The supply shall be accessible to all parts of the plant, adequate in quantity, and of a safe sanitary quality. No cross connections with unapproved supplies or other possible sources of contamination shall be permitted.

## SECTION 1236 [DPH] LABORATORY ANIMAL QUARTERS

Laboratory animal quarters shall meet the requirements of Part 12 California Referenced Standards Code, Chapter 12-4A, Section 12-4A-101.

See the 2010 Edition, Title 24, Part 12, Chapter 12-4A.

## SECTION 1237 [DPH] WILD ANIMAL QUARANTINE FACILITIES

**1237.1 Scope.** The provisions of this section are intended to provide standards for the quarantine of wild animals.

**1237.2 Definitions.** For the purpose of this chapter, the following terms shall have the meaning indicated:

**ESCAPEPROOF** is a condition that will prohibit unintended release of wild animals from their quarantine enclosure.

**HOUSING FACILITY** is a room, building or area used to contain a primary enclosure or enclosures for animal quarantine.

**PRIMARY ENCLOSURE** is a structure used to immediately restrict an animal or animals to a limited amount of space,

such as a room, pen, run, cage or compartment within the quarantine facility.

**QUARANTINE FACILITY** is a facility for the quarantine confinement of imported wild animals.

**SPACE CONDITIONING** is the regulation of ambient temperature.

### 1237.3 Construction.

**1237.3.1 General.** Housing facilities used for quarantine shall be constructed in accordance with these provisions and Group B occupancy requirements.

**1237.3.2 Entry.** Quarantine housing facilities shall restrict the entry of other animals and unauthorized persons by locking or bolting devices or other equipment methods.

Rooms containing primary enclosures shall be entered through double doors that maintain a minimum distance of 4 feet (1219 mm) between doors permitting closure of one door before the second is opened.

All animals must be visible through a viewpoint from the entry area.

Windows to the outside shall be escapeproof.

One handwashing sink shall be provided in each room in which animals are quarantined.

**1237.3.3 Special provision.** The interior building surfaces of housing facilities shall be smooth and impervious to moisture.

**1237.4 Light and ventilation.** All portions of the wild animal quarantine facility shall be space conditioned to maintain the health of the wild animals. Ventilation shall be provided in housing facilities so as not to create a health hazard by one or more of the following methods.

1. Openable windows
2. Doors
3. Vents
4. Air conditioning
5. Fans

Uniformly distributed illumination of not less than 50 footcandles (538 lux) at least the level of the cage racks shall be provided.

**1237.5 Primary enclosure.** Primary enclosures shall be capable of containing quarantined animals and excluding access by other animals. Enclosures shall provide space to allow each animal to make normal postural adjustments with freedom of movement and maintain social activity. Primates shall be provided with a minimum floor space equal to an area of at least three times the area occupied by such primates when standing on four feet.

## SECTION 1238 Reserved

## SECTION 1239 Reserved

### SECTION 1240 [AGR] MEAT AND POULTRY PROCESSING PLANTS

**1240.1 General construction.** The buildings shall be of sound construction and kept in good repair.

**1240.1.1** The doors, windows, skylights and other outside openings of the plant, shall be protected by fitted screens or other devices, such as air screens, against the entrance of flies and other insects.

**1240.1.2** Outside doors shall be hung so as to be close fitting when closed.

**1240.1.3** Rooms or compartments used for edible products shall be separated and distinct from inedible products departments and from rooms where live poultry are held or slaughtered. Separate rooms shall be provided when required for conducting processing operations in a sanitary manner; and all rooms shall be able to accommodate equipment for processing operations.

**Note:** In the event of specific conflict, in federally inspected plants, between the provisions of Title 24 and federal regulations, the federal regulations shall take precedence.

**1240.1.4** The rooms and compartments in which any product is prepared or handled shall be free from objectionable odors.

**1240.1.5** The outer premises of every official establishment, including docks and areas where cars and vehicles are loaded, and the driveways, approaches, yards, pens and alleys shall be paved.

**1240.2 Refuse rooms.** A separate refuse room shall be required in official establishments where accumulations of refuse occur. Refuse rooms shall be entirely separate from other rooms in the establishment, and shall provide for the following:

1. Tight fitting doors.
2. Ventilation.
3. Drainage.
4. Cleanup facilities.
5. Floors and walls to a height of 6 feet (1829 mm) above the floor shall be impervious to moisture.
6. Wall above 6 feet (1829 mm), and ceilings shall be moisture resistant.

**1240.3 Rooms for holding carcasses for further inspection.** Room or other acceptable facilities in which carcasses or parts thereof are held for further inspection shall be in such numbers and such locations as needs of the inspection in the establishment may require. These rooms or facilities shall be equipped with hasps for locking.

**1240.4 Coolers and freezers.** Coolers and freezers shall be of adequate size and capacity and have cooling capability to fully enable compliance with the regulations governing the

inspection of meat and poultry and meat and poultry products.

**1240.5 Boiler room.** The boiler room shall be a separate room where necessary to prevent dirt and objectionable odors entering from it into any room where dressed poultry or poultry products are prepared, handled or stored.

**1240.6 Inspector's office.** Office space for the use of government personnel shall be provided. The room or space must meet the approval of the inspection service and provide for the following:

1. Light
2. Heat
3. Ventilation
4. Desk space
5. File cabinets

**1240.7 Facilities for program employees.** Establishments shall have facilities for program employees.

**1240.8 Lunch rooms.** Lunch rooms or lunch areas separate from the processing, packing or supply rooms shall be provided in establishments where employees eat their lunches.

**1240.9 Floors.** All floors in rooms where exposed products are prepared or handled shall be constructed of, or finished with, materials impervious to moisture. The floors in killing, ice cooling, ice packing, eviscerating, cooking, boning and cannery rooms shall be graded for complete runoff with no standing water.

**1240.10 Walls, posts, partitions and doors.** All walls, posts, partitions and doors in rooms where exposed products are prepared or handled shall be smooth and constructed of materials impervious to moisture to a height of at least 8 feet (2438 mm) above the floor. All surfaces above this height must be smooth and finished with moisture-resistant material.

**1240.11 Ceilings.** Ceilings must be moisture resistant in rooms where exposed products are prepared or handled, finished and sealed.

**1240.12 Rails.** Rails should be located and passageway space provided so that exposed product does not come in contact with posts, walls and other fixed parts of the building, or with barrels, boxes or other containers trafficked through holding and operation areas.

**1240.13 Lighting.** There shall be either natural or artificial light or both for all rooms and compartments.

**1240.13.1** All rooms in which poultry or livestock are killed, eviscerated or otherwise processed shall have at least 30 foot-candles (323 lux) of light intensity on all working surfaces.

#### **Exceptions:**

1. At the inspection stations such light intensity shall be at least 50 footcandles (538 lux).
2. In all other rooms in which poultry or livestock are not killed, eviscerated or otherwise processed, there shall be provided at least 5 footcandles (54 lux) of light intensity when measured at a distance of 30 inches (762 mm) from the floor.

## INTERIOR ENVIRONMENT

**1240.14 Ventilation.** There shall be either natural or artificial ventilation, adequate to control odors, vapors, and condensation to the extent necessary to prevent adulteration of product and the creation of insanitary conditions, in all rooms and compartments.

**1240.14.1** Freezing rooms, other than those for plate freezers or liquid freezing, shall have forced-air circulation, and freezers and coolers shall be equipped with floor racks or pallets unless other means are used which will assure that products will be maintained in a wholesome condition.

**1240.14.2** Toilet rooms shall be ventilated to the outside of the building.

### **1240.15 Lavatories, toilets and other sanitary facilities.**

**1240.15.1** Lavatory and toilet accommodations, including but not limited to, running hot and cold water, shall be provided as follows in Table 1240.15.1.

**TABLE 1240.15.1**

PERSONS OF SAME SEX	TOILET BOWLS REQUIRED
1 to 15, inclusive	1
1 to 15, inclusive	2
1 to 15, inclusive	3*
1 to 15, inclusive	4*
For each additional 30 persons in excess of 80	1*

\* Urinals may be substituted for toilet bowls, but only to the extent of one-third of the total number of bowls stated.

**1240.15.2** Lavatories shall be in or adjacent to toilet and locker rooms and at other places in the plant to provide for the cleanliness of all personnel handling products.

**1240.15.3** Toilet rooms opening directly into rooms where products are exposed shall have self-closing doors.

**1240.15.4** Dressing rooms and toilet rooms shall be provided in each establishment and shall be ample in size and readily accessible. They shall be separated from the rooms and compartments in which products are prepared, stored or handled. Where both sexes are employed, separate facilities shall be provided.

**1240.15.5** Lockers or other facilities shall be provided for employees' wearing apparel and for the storing and changing of clothing. Lockers shall not be located in rooms where processing operations are conducted.

**1240.15.6** Handwashing facilities serving areas where dressed livestock and poultry carcasses and parts and meat and poultry products are prepared shall be operated by other than hand-operated controls, or shall be continuous flow type that provides flow of water for washing hands.

**1240.15.7 Catch basins.** All catch basins on the premises shall accommodate the provisions of Section 1243.5.

## **SECTION 1241 [AGR] COLLECTION CENTERS AND FACILITIES**

### **1241.1 General construction.**

**1241.1.1** Collection centers shall have facilities for the storage of carcasses and parts of dead animals and the cleaning and sanitizing of vehicles.

**1241.1.2** Buildings used for the temporary storage of animal carcasses, packinghouse wastes and other products before transportation to a licensed rendering plant shall be of sound construction and shall be of such construction as to prevent the entrance or harboring of vermin.

**1241.1.3** The floors, walls, ceilings, partitions and doors shall be of such material, construction and finish as to make them readily cleanable.

**1241.1.4** The area for the cleaning and sanitizing of vehicles shall be provided with adequate live steam or hot water, producing a temperature of at least 180°F (82°C), or other method for sanitizing vehicles.

**1241.1.5** Facilities shall be provided for the holding and disposal of solid waste resulting from the cleaning operation. Such facilities shall be accessible and easily cleaned and so constructed as to prevent the entrance or harborage of vermin, flies and other insects.

**1241.1.6** The cleaning and sanitizing of vehicles shall be done on a slab of concrete or other material approved by the Department, which is sloped to drains so as to permit the rapid runoff of water.

**1241.1.7** Carcasses and packinghouse waste. The unloading slab shall be of sufficient size to hold all animal carcasses and packinghouse waste material, be constructed of concrete or other material approved by the Department and sloped to drains so as to permit the rapid runoff of water.

**1241.2 Floors.** Floors of rooms in which carcasses and packinghouse wastes are received or stored shall be graded to permit runoff of water with no standing water. In new construction and in renovated buildings where floors are to be resurfaced, the pitch shall not be less than 1/4 inch per foot (2 percent) to drains.

**1241.3 Lavatories and toilets.** Modern lavatory accommodations, including running hot and cold water, shall be provided except where the Department determines that they are not necessary.

## **SECTION 1242 [AGR] RENDERERS**

### **1242.1 General construction.**

**1242.1.1 Separation from other businesses.** Every licensed rendering establishment shall be separate and distinct from any establishments in which any meat, meat byproducts, poultry, or poultry byproducts are handled and from any other business at the discretion of the Department.

**1242.1.2** The cleaning and sanitizing of vehicles shall be done on a slab of concrete or other material approved by the Department; which is sloped to drains so as to permit the rapid runoff of water.

## **SECTION 1243 [AGR] HORSEMEAT AND PET FOOD ESTABLISHMENTS**

**1243.1 Scope.** In the event of specific conflict between the provisions of Title 24 and federal regulations, the federal regulations shall take precedence in establishments under federal inspection.

### **1243.2 General.**

**1243.2.1 Facilities for program employees.** Office space, including light and heat shall be provided by official establishments for the inspector and other program employees. The office space shall be conveniently located and adequately ventilated, heated, cooled, and provided with adequate desk and file space.

### **1243.2.2 Final inspection places.**

**1243.2.2.1 Final inspection places** shall, by size, rail arrangement and other equipment, prevent contamination of edible carcasses or parts by inedible carcasses or parts.

**1243.2.2.2 Floors.** The floors shall be of such construction as to facilitate the maintenance of sanitary conditions and shall have drainage connections. When the final inspection place is part of a larger floor, it shall be separated from the rest of the floor by a curb, railing or otherwise.

**1243.2.3 Docks and receiving rooms.** Docks and receiving rooms shall be provided.

**1243.2.4 The floors, walls, ceilings, partitions, posts, doors and other parts of all structures** shall be of such material, construction and finish as will make them readily and thoroughly cleanable. The floors shall be kept watertight.

**1243.2.5 Rails.** Rails shall be located and passageway space provided, so that exposed product does not come in contact with post, walls and other fixed parts of the building, or with barrels, boxes and other containers trafficked through holding and operation areas.

**1243.2.6 The rooms and compartments used for edible products** shall be separated and distinct from those used for inedible products.

**1243.2.7 The rooms and compartments in which any product is prepared or handled** shall be free from objectionable odor.

**1243.2.8 Precaution** shall be taken to exclude flies, rats, mice and other vermin from official establishments.

**1243.2.9 The outer premises of horsemeat and pet food establishments** shall meet the requirements of Section 1240.1.5.

**1243.3 Lighting.** There shall be light and ventilation for all rooms and compartments.

**1243.4 Sanitary facilities and accommodations.** Sanitary facilities and accommodations shall be furnished by every official establishment.

**1243.4.1 Dressing rooms and toilet rooms** shall be provided in each establishment and shall be ample in size and readily accessible. They shall be separated from the rooms

and compartments in which products are prepared, stored or handled. Where both sexes are employed, separate facilities shall be provided.

**1243.4.2 Lavatories,** including running hot and cold water, shall be placed in or adjacent to toilet and urinal rooms and at other places in the establishment to assure cleanliness of all persons handling any product.

**1243.4.3 Facilities** shall be provided for cleansing and disinfecting utensils.

**1243.5 Catch basins.** All catch basins on the premises shall be of such construction and location to ensure they are kept clean and odorless. Catch basins shall not be located in department where any product is prepared, handled or stored.

**1243.6 Final inspection space.** Such spaces shall be equipped with hot water and a lavatory.

## **SECTION 1244 Reserved**

## **SECTION 1245 Reserved**

## **SECTION 1246 Reserved**

## **SECTION 1247 Reserved**

## **SECTION 1248 Reserved**

## **SECTION 1249 Reserved**

## **SECTION 1250 [CA] PHARMACIES**

**1250.1 Application.** This section applies to pharmacies listed in Section 1.4.1 regulated by the Department of Consumer Affairs.

**1250.2 Restrooms.** A pharmacy shall maintain a readily accessible restroom. The restroom shall contain a toilet and washbasin supplied with running water.

**1250.3 Sink.** All pharmacies shall be equipped with a sink within the pharmacy for pharmaceutical purposes. The sink shall be supplied with hot and cold running water.

**1250.4 Compounding area for parenteral solutions.** The pharmacy shall have a designated area for the preparation of sterile products for dispensing which shall:

1. In accordance with Federal Standard 209 (b), Clean Room and Work Station Requirements, Controlled

*Environment as approved by the Commission, Federal Supply Service, General Service Administration meet standards for Class 100 HEPA (high efficiency particulate air) filtered air such as laminar airflow hood or clean room.*

2. *Have nonporous and cleanable surfaces, ceilings and ceiling tiles, walls, floors and floor coverings.*
3. *The pharmacy shall be arranged in such a manner that the laminar-flow hood is located in an area which is exposed to minimal traffic flow, and is separate from any area used for bulk storage of items not related to the compounding of parenteral solutions.*

*There shall be sufficient space, well separated from the laminar-flow hood area for the storage of bulk materials, equipment and waste materials.*

4. *A sink with hot and cold running water must be within the parenteral solution compounding area or adjacent to it.*
5. *Any pharmacy that compounds sterile injectable products from one or more nonsterile ingredients must compound the medication in one of the following environments:*
  - 5.1 *An ISO class 5 laminar airflow hood within an ISO class 7 cleanroom. The cleanroom must have a positive air pressure differential relative adjacent areas.*
  - 5.2 *An ISO class 5 cleanroom.*
  - 5.3 *A barrier isolator that provides an ISO class 5 environment for compounding.*

**Note:** *For additional pharmacy mechanical standard requirements, see Chapter 5, California Mechanical Code.*

## **SECTION 1251 [CA] VETERINARY FACILITIES**

**1251.1** *All premises where veterinary medicine, veterinary dentistry or veterinary surgery is being practiced, and all instruments, apparatus and apparel used in connection with those practices, shall be kept clean and sanitary at all times and shall conform to the standards of this section.*

**1251.2** *Indoor lighting for halls, wards, reception areas and examining and surgical rooms shall be adequate for their intended purpose. All surgical rooms shall be provided with emergency lighting.*

**1251.3** *A veterinary facility where animals are housed shall contain the following:*

1. *A reception room and office, or a combination of the two.*
2. *An examination room separate from other areas of the facility and of sufficient size to accommodate the doctor, assistant, patient and client.*
3. *A surgery room separate and distinct from all other rooms.*

4. *Housing. In those veterinary hospitals where animals are retained for treatment or hospitalization, the following shall be provided:*

- 4.1. *Separate compartments, one for each animal, maintained in a sanitary manner so as to assure comfort.*
- 4.2. *Facilities allowing for the effective separation of contagious and noncontagious cases.*
- 4.3. *Exercise runs which provide and allow effective separation of animals and their waste products.*

**Note:** *Where animals are kept in clinics for 24 hours or more, walking the animal meets this requirement.*

### **1251.4 Practice management.**

**1251.4.1** *Veterinary facilities shall maintain a sanitary environment to avoid sources and transmission of infection. This is to include the proper routine of disposal of waste materials and proper sterilization or sanitation of all equipment used in diagnosis or treatment.*

**1251.4.2** *Fire precautions shall meet the requirements of local and state fire prevention codes.*

**1251.4.3** *The temperature and ventilation of the facility shall be maintained so as to assure the comfort of all patients.*

**1251.4.4** *The veterinary facility must have the capacity to render adequate diagnostic radiological services, either in the hospital or through other commercial facilities. Radiological procedures shall be in accordance with state public health standards.*

**1251.4.5** *Sanitary methods for the disposal of deceased animals shall be provided and maintained. Where the owner of a deceased animal has not given the veterinarian authorization to dispose of the animal, the veterinarian shall be required to retain the carcass in a freezer for at least 14 days.*

## **SECTION 1252 [CA] BARBER COLLEGES AND SHOPS**

**1252.1 Barber college floors.** *Floors of barber colleges shall be covered with hardwood, linoleum, asphalt tile or some other washable and nonporous material other than paint.*

**1252.2 Barber shop floors.** *Floors of barber shops shall be covered with hardwood, linoleum, asphalt tile, carpeting or some other washable material other than paint.*

**1252.3 Barber shop washbasin(s) and lavatory(ies).** *A barber shop owner shall provide washbasin(s) or lavatory(ies) within the working area of the barber shop.*

**1252.4 Minimum barber shop size.** *A barber shop shall be a minimum of 8 feet (2438 mm) wide, 8 feet (2438 mm) long, with an 8-foot (2438 mm) ceiling.*

**1252.5 Barber college premises.** *In a college of barbering, the room for practical work and demonstrations shall be at least 14 feet (4267 mm) wide for one row of barber chairs and shall be at least 20 feet (6096 mm) wide for two rows of chairs.*



**SECTION 1253 [CA]  
SCHOOLS OF COSMETOLOGY,  
COSMETOLOGICAL ESTABLISHMENTS AND  
SATELLITE CLASSROOMS**

**1253.1 Floor space.**

**1253.1.1 Schools of cosmetology.** *The minimum floor space in any school of cosmetology premises shall be 3,000 square feet (279 m<sup>2</sup>), not less than 2,000 square feet (185.8 m<sup>2</sup>) of which shall be provided for the working, practice and classroom areas.*

**Exception:** *When the average daily attendance for either day or night school in a school of cosmetology exceeds 50 students for a period of three months, an additional 30 square feet (2.8 m<sup>2</sup>) of floor space shall be required for each additional student after the first 50, which shall be provided for the working, practice and classroom areas.*

**1253.1.2 Schools of electrology.** *The minimum floor space in any school of electrology premises shall be 1,000 square feet (93 m<sup>2</sup>), not less than 600 square feet (55.7 m<sup>2</sup>) of which shall be provided for the working, practice and classroom areas.*

**Exception:** *When the average daily attendance for either day or night school of electrology exceeds 15 students, an additional 30 square feet (2.8 m<sup>2</sup>) of floor space shall be required for each additional student after the first 15, which shall be provided for working, practice and classroom areas.*

**1253.1.3 Satellite classrooms.** *The minimum floor space in any satellite classroom of a school of cosmetology or electrology shall be 1,000 square feet (93 m<sup>2</sup>).*

**Exception:** *For each additional student after the first 50, an additional 20 square feet (1.9 m<sup>2</sup>) of floor space shall be required.*

**1253.2 Floor finish.** *The floors in the toilet area of each school and establishment shall be of nonabsorbent material.*

**1253.3 Ceiling height.** *The minimum ceiling height of the practice and classroom areas of school premises shall be at least 9 feet (2743 mm) in height.*

**SECTION 1254 [CA]  
ACUPUNCTURE OFFICES**

**1254.1 Acupuncture offices.** *Every acupuncture office shall have a readily accessible bathroom facility which shall be maintained in a clean and sanitary condition at all times. In addition, there shall be a sink with hot and cold running water in or near each treatment room.*



## CHAPTER 13

# ENERGY EFFICIENCY

*Refer to California Energy Code, Title 24, Part 6.*



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 14 – EXTERIOR WALLS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X																			
Adopt entire chapter as amended (amended sections listed below)							X	X	X	X		X								
Adopt only those sections that are listed below		X																		
Chapter / Section																				
1401		X																		
1402		X																		
1403.4		X																		
1404		X																		
1405		X																		
1405.1.1							X	X	X	X		X								
1406		X																		
1407		X																		
1408		X																		
1410							X	X	X	X		X								

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 111.*



## CHAPTER 14

# EXTERIOR WALLS

### SECTION 1401 GENERAL

**1401.1 Scope.** The provisions of this chapter shall establish the minimum requirements for exterior walls; exterior wall coverings; exterior wall openings; exterior windows and doors; architectural trim; balconies and similar projections; and bay and oriel windows.

### SECTION 1402 DEFINITIONS

**1402.1 Definitions.** The following terms are defined in Chapter 2:

**ADHERED MASONRY VENEER.**

**ANCHORED MASONRY VENEER.**

**BACKING.**

**EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS).**

**EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE.**

**EXTERIOR WALL.**

**EXTERIOR WALL COVERING.**

**EXTERIOR WALL ENVELOPE.**

**FIBER-CEMENT SIDING.**

**HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL).**

**HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL) SYSTEM.**

**METAL COMPOSITE MATERIAL (MCM).**

**METAL COMPOSITE MATERIAL (MCM) SYSTEM.**

**POLYPROPYLENE SIDING.**

**PORCELAIN TILE.**

**VENEER.**

**VINYL SIDING.**

**WATER-RESISTIVE BARRIER.**

### SECTION 1403 PERFORMANCE REQUIREMENTS

**1403.1 General.** The provisions of this section shall apply to exterior walls, wall coverings and components thereof.

**1403.2 Weather protection.** Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.4. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-

resistive barrier behind the exterior veneer, as described in Section 1404.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the exterior wall assembly shall be provided in accordance with Section 1405.3.

#### Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1404.2 and 1405.4, shall not be required for an exterior wall envelope that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
  - 2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
  - 2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
  - 2.3. Exterior wall envelope assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m<sup>2</sup>).
  - 2.4. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

3. Exterior insulation and finish systems (EIFS) complying with Section 1408.4.1.

**1403.3 Structural.** Exterior walls, and the associated openings, shall be designed and constructed to resist safely the superimposed loads required by Chapter 16.

**1403.4 Fire resistance.** Exterior walls shall be fire-resistance rated as required by other sections of this code with opening protection as required by Chapter 7.

**1403.5 Vertical and lateral flame propagation.** Exterior walls on buildings of Type I, II, III or IV construction that are greater than 40 feet (12 192 mm) in height above grade plane

## EXTERIOR WALLS

and contain a combustible water-resistive barrier shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

**1403.6 Flood resistance.** For buildings in flood hazard areas as established in Section 1612.3, exterior walls extending below the elevation required by Section 1612 shall be constructed with flood-damage-resistant materials. Wood shall be pressure-preservative treated in accordance with AWP A U1 for the species, product and end use using a preservative listed in Section 4 of AWP A U1 or decay-resistant heartwood of redwood, black locust or cedar.

**1403.7 Flood resistance for high-velocity wave action areas.** For buildings in flood hazard areas subject to high-velocity wave action as established in Section 1612.3, electrical, mechanical and plumbing system components shall not be mounted on or penetrate through exterior walls that are designed to break away under flood loads.

### SECTION 1404 MATERIALS

**1404.1 General.** Materials used for the construction of exterior walls shall comply with the provisions of this section. Materials not prescribed herein shall be permitted, provided that any such alternative has been approved.

**1404.2 Water-resistive barrier.** A minimum of one layer of No.15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other approved materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

**1404.3 Wood.** Exterior walls of wood construction shall be designed and constructed in accordance with Chapter 23.

**1404.3.1 Basic hardboard.** Basic hardboard shall conform to the requirements of AHA A135.4.

**1404.3.2 Hardboard siding.** Hardboard siding shall conform to the requirements of AHA A135.6 and, where used structurally, shall be so identified by the label of an approved agency.

**1404.4 Masonry.** Exterior walls of masonry construction shall be designed and constructed in accordance with this section and Chapter 21. Masonry units, mortar and metal accessories used in anchored and adhered veneer shall meet the physical requirements of Chapter 21. The backing of anchored and adhered veneer shall be of concrete, masonry, steel framing or wood framing.

**1404.5 Metal.** Exterior walls of formed steel construction, structural steel or lightweight metal alloys shall be designed in accordance with Chapters 22 and 20, respectively.

**1404.5.1 Aluminum siding.** Aluminum siding shall conform to the requirements of AAMA 1402.

**1404.5.2 Cold-rolled copper.** Copper shall conform to the requirements of ASTM B 370.

**1404.5.3 Lead-coated copper.** Lead-coated copper shall conform to the requirements of ASTM B 101.

**1404.6 Concrete.** Exterior walls of concrete construction shall be designed and constructed in accordance with Chapter 19.

**1404.7 Glass-unit masonry.** Exterior walls of glass-unit masonry shall be designed and constructed in accordance with Chapter 21.

**1404.8 Plastics.** Plastic panel, apron or spandrel walls as defined in this code shall not be limited in thickness, provided that such plastics and their assemblies conform to the requirements of Chapter 26 and are constructed of approved weather-resistant materials of adequate strength to resist the wind loads for cladding specified in Chapter 16.

**1404.9 Vinyl siding.** Vinyl siding shall be certified and labeled as conforming to the requirements of ASTM D 3679 by an approved quality control agency.

**1404.10 Fiber-cement siding.** Fiber-cement siding shall conform to the requirements of ASTM C 1186, Type A, and shall be so identified on labeling listing an approved quality control agency.

**1404.11 Exterior insulation and finish systems.** Exterior insulation and finish systems (EIFS) and exterior insulation and finish systems (EIFS) with drainage shall comply with Section 1408.

**1404.12 Polypropylene siding.** Polypropylene siding shall be certified and labeled as conforming to the requirements of ASTM D 7254 and those of Section 1404.12.1 or 1404.12.2 by an approved quality control agency. Polypropylene siding shall be installed in accordance with the requirements of Section 1405.18 and in accordance with the manufacturer's installation instructions. Polypropylene siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

**1404.12.1 Flame spread index.** The certification of the flame spread index shall be accompanied by a test report stating that all portions of the test specimen ahead of the flame front remained in position during the test in accordance with ASTM E 84 or UL 723.

**1404.12.2 Fire separation distance.** The fire separation distance between a building with polypropylene siding and the adjacent building shall be no less than 10 feet (3048 mm).



## SECTION 1405 INSTALLATION OF WALL COVERINGS

**1405.1 General.** Exterior wall coverings shall be designed and constructed in accordance with the applicable provisions of this section.

**1405.1.1 Additional requirements.** [DSA-SS & DSA-SS/CC, OSHPD 1, 2 & 4] In addition to the requirements of Sections 1405.6, 1405.7, 1405.8, 1405.9, and 1405.10, the installation of anchored or adhered veneer shall comply with applicable provisions of Section 1410.

**1405.2 Weather protection.** Exterior walls shall provide weather protection for the building. The materials of the minimum nominal thickness specified in Table 1405.2 shall be acceptable as approved weather coverings.

**1405.3 Vapor retarders.** Class I or II vapor retarders shall be provided on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4. The appropriate zone shall be selected in accordance with Chapter 3 of the *California Energy Conservation Code*.

[HCD 1 & HCD 2] Class I or II vapor retarders shall be provided on the interior side of frame walls of low-rise residential buildings as required in Title 24, Part 6, the *California Energy Code* (see definition of “Low-rise residential building”).

### Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

**1405.3.1 Class III vapor retarders.** Class III vapor retarders shall be permitted where any one of the conditions in Table 1405.3.1 is met.

[HCD 1 & HCD 2] Class III vapor retarders shall be permitted where any one of the conditions in Items 1, 2 or 3 below are met. This section shall apply to “Low-rise residential buildings” as defined in Title 24, Part 6, the *California Energy Code*.

1. Vented cladding over fiberboard
2. Vented cladding over gypsum
3. Insulated sheathing with  $R\text{-value} \geq R4$

Spray foam with a minimum density of 2 lbs/ft<sup>3</sup> applied to the interior cavity side of OSB, plywood, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam  $R\text{-value}$  meets or exceeds the specified insulating sheathing  $R\text{-value}$ .

**TABLE 1405.2  
MINIMUM THICKNESS OF WEATHER COVERINGS**

COVERING TYPE	MINIMUM THICKNESS (inches)
Adhered masonry veneer	0.25
Aluminum siding	0.019
Anchored masonry veneer	2.625
Asbestos-cement boards	0.125
Asbestos shingles	0.156
Cold-rolled copper <sup>d</sup>	0.0216 nominal
Copper shingles <sup>d</sup>	0.0162 nominal
Exterior plywood (with sheathing)	0.313
Exterior plywood (without sheathing)	See Section 2304.6
Fiber cement lap siding	0.25 <sup>c</sup>
Fiber cement panel siding	0.25 <sup>c</sup>
Fiberboard siding	0.5
Glass-fiber reinforced concrete panels	0.375
Hardboard siding <sup>c</sup>	0.25
High-yield copper <sup>d</sup>	0.0162 nominal
Lead-coated copper <sup>d</sup>	0.0216 nominal
Lead-coated high-yield copper	0.0162 nominal
Marble slabs	1
Particleboard (with sheathing)	See Section 2304.6
Particleboard (without sheathing)	See Section 2304.6
Porcelain tile	.025
Precast stone facing <sup>e</sup>	0.625
Steel (approved corrosion resistant)	0.0149
Stone (cast artificial, anchored)	1.5
Stone (natural)	2
Structural glass	0.344
Stucco or exterior cement plaster	
Three-coat work over:	
Metal plaster base	0.875 <sup>b</sup>
Unit masonry	0.625 <sup>b</sup>
Cast-in-place or precast concrete	0.625 <sup>b</sup>
Two-coat work over:	
Unit masonry	0.5 <sup>b</sup>
Cast-in-place or precast concrete	0.375 <sup>b</sup>
Terra cotta (anchored)	1
Terra cotta (adhered)	0.25
Vinyl siding	0.035
Wood shingles	0.375
Wood siding (without sheathing) <sup>a</sup>	0.5

For SI: 1 inch = 25.4 mm.

- a. Wood siding of thicknesses less than 0.5 inch shall be placed over sheathing that conforms to Section 2304.6.
- b. Exclusive of texture.
- c. As measured at the bottom of decorative grooves.
- d. 16 ounces per square foot for cold-rolled copper and lead-coated copper, 12 ounces per square foot for copper shingles, high-yield copper and lead-coated high-yield copper.
- e. Includes scratch coat, setting bed, and precast stone.

**TABLE 1405.3.1**  
**CLASS III VAPOR RETARDERS**

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:*
Marine 4	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with $R$ -value $\geq R2.5$ over $2 \times 4$ wall Insulated sheathing with $R$ -value $\geq R3.75$ over $2 \times 6$ wall
5	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with $R$ -value $\geq R5$ over $2 \times 4$ wall Insulated sheathing with $R$ -value $\geq R7.5$ over $2 \times 6$ wall
6	Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with $R$ -value $\geq R7.5$ over $2 \times 4$ wall Insulated sheathing with $R$ -value $\geq R11.25$ over $2 \times 6$ wall
7 and 8	Insulated sheathing with $R$ -value $\geq R10$ over $2 \times 4$ wall Insulated sheathing with $R$ -value $\geq R15$ over $2 \times 6$ wall

For SI: 1 pound per cubic foot = 16 kg/m<sup>3</sup>.

- a. Spray foam with a minimum density of 2 lbs/ft<sup>3</sup> applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam  $R$ -value meets or exceeds the specified insulating sheathing  $R$ -value.

**1405.3.2 Material vapor retarder class.** The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

- Class I: Sheet polyethylene, nonperforated aluminum foil.
- Class II: Kraft-faced fiberglass batts or paint with a perm rating greater than 0.1 and less than or equal to 1.0.
- Class III: Latex or enamel paint.

**1405.3.3 Minimum clear airspaces and vented openings for vented cladding.** For the purposes of this section, vented cladding shall include the following minimum clear airspaces.

1. Vinyl lap or horizontal aluminum siding applied over a weather-resistive barrier as specified in this chapter.
2. Brick veneer with a clear airspace as specified in this code.
3. Other approved vented claddings.

**1405.4 Flashing.** Flashing shall be installed in such a manner so as to prevent moisture from entering the wall or to redirect it to the exterior. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations and terminations of exterior wall assemblies, exterior wall intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with pro-

jecting flanges shall be installed on both sides and the ends of copings, under sills and continuously above projecting trim.

**1405.4.1 Exterior wall pockets.** In exterior walls of buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with caps or drips, or other approved means shall be provided to prevent water damage.

**1405.4.2 Masonry.** Flashing and weep holes in anchored veneer shall be located in the first course of masonry above finished ground level above the foundation wall or slab, and other points of support, including structural floors, shelf angles and lintels where anchored veneers are designed in accordance with Section 1405.6.

**1405.5 Wood veneers.** Wood veneers on exterior walls of buildings of Type I, II, III and IV construction shall be not less than 1 inch (25 mm) nominal thickness, 0.438-inch (11.1 mm) exterior hardboard siding or 0.375-inch (9.5 mm) exterior-type wood structural panels or particleboard and shall conform to the following:

1. The veneer shall not exceed 40 feet (12 190 mm) in height above grade. Where fire-retardant-treated wood is used, the height shall not exceed 60 feet (18 290 mm) in height above grade.
2. The veneer is attached to or furred from a noncombustible backing that is fire-resistance rated as required by other provisions of this code.
3. Where open or spaced wood veneers (without concealed spaces) are used, they shall not project more than 24 inches (610 mm) from the building wall.

**1405.6 Anchored masonry veneer.** Anchored masonry veneer shall comply with the provisions of Sections 1405.6, 1405.7, 1405.8 and 1405.9 and Sections 6.1 and 6.2 of TMS 402/ACI 530/ASCE 5.

**1405.6.1 Tolerances.** Anchored masonry veneers in accordance with Chapter 14 are not required to meet the tolerances in Article 3.3 F1 of TMS 602/ACI 530.1/ASCE 6.

**1405.6.2 Seismic requirements.** Anchored masonry veneer located in Seismic Design Category C, D, E or F shall conform to the requirements of Section 6.2.2.10 of TMS 402/ACI 530/ASCE 5.

**1405.7 Stone veneer.** Stone veneer units not exceeding 10 inches (254 mm) in thickness shall be anchored directly to masonry, concrete or to stud construction by one of the following methods:

1. With concrete or masonry backing, anchor ties shall be not less than 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, formed beyond the base of the backing. The legs of the loops shall be not less than 6 inches (152 mm) in length bent at right angles and laid in the mortar joint, and spaced so that the eyes or loops are 12 inches (305 mm) maximum on center (o.c.) in both directions. There shall be provided not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire tie, or approved equal, threaded through the exposed loops for every 2 square feet (0.2 m<sup>2</sup>) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length bent so that it will lie in the stone veneer

mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.

2. With wood stud backing, a 2-inch by 2-inch (51 by 51 mm) 0.0625-inch (1.59 mm) zinc-coated or non-metallic coated wire mesh with two layers of water-resistive barrier in accordance with Section 1404.2 shall be applied directly to wood studs spaced a maximum of 16 inches (406 mm) o.c. On studs, the mesh shall be attached with 2-inch long (51 mm) corrosion-resistant steel wire furring nails at 4 inches (102 mm) o.c. providing a minimum 1.125-inch (29 mm) penetration into each stud and with 8d annular threaded nails at 8 inches (203 mm) o.c. into top and bottom plates or with equivalent wire ties. There shall be not less than a 0.1055-inch (2.68 mm) zinc-coated or nonmetallic coated wire, or approved equal, attached to the stud with a minimum of an 8d (0.120 in. diameter) annular threaded nail for every 2 square feet (0.2 m<sup>2</sup>) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length, so bent that it will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.
3. With cold-formed steel stud backing, a 2-inch by 2-inch (51 by 51 mm) 0.0625-inch (1.59 mm) zinc-coated or nonmetallic coated wire mesh with two layers of water-resistive barrier in accordance with Section 1404.2 shall be applied directly to steel studs spaced a maximum of 16 inches (406 mm) o.c. The mesh shall be attached with corrosion-resistant #8 self-drilling, tapping screws at 4 inches (102 mm) o.c., and at 8 inches (203 mm) o.c. into top and bottom tracks or with equivalent wire ties. All screws shall extend through the steel connection a minimum of three exposed threads. There shall be not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, attached to the stud with a minimum of a #8 self-drilling, tapping screw extending through the steel framing a minimum of three exposed threads for every 2 square feet (0.2 m<sup>2</sup>) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length, so bent that it will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer. The cold-formed steel framing members shall have a minimum bare steel thickness of 0.0428 inches (1.087 mm).

**1405.8 Slab-type veneer.** Slab-type veneer units not exceeding 2 inches (51 mm) in thickness shall be anchored directly to masonry, concrete or stud construction. For veneer units of marble, travertine, granite or other stone units of slab form ties of corrosion-resistant dowels in drilled holes shall be located in the middle third of the edge of the units, spaced a maximum of 24 inches (610 mm) apart around the periphery of each unit with not less than four ties per veneer unit. Units

shall not exceed 20 square feet (1.9 m<sup>2</sup>) in area. If the dowels are not tight fitting, the holes shall be drilled not more than 0.063 inch (1.6 mm) larger in diameter than the dowel, with the hole countersunk to a diameter and depth equal to twice the diameter of the dowel in order to provide a tight-fitting key of cement mortar at the dowel locations when the mortar in the joint has set. Veneer ties shall be corrosion-resistant metal capable of resisting, in tension or compression, a force equal to two times the weight of the attached veneer. If made of sheet metal, veneer ties shall be not smaller in area than 0.0336 by 1 inch (0.853 by 25 mm) or, if made of wire, not smaller in diameter than 0.1483-inch (3.76 mm) wire.

**1405.9 Terra cotta.** Anchored terra cotta or ceramic units not less than 1<sup>5</sup>/<sub>8</sub> inches (41 mm) thick shall be anchored directly to masonry, concrete or stud construction. Tied terra cotta or ceramic veneer units shall be not less than 1<sup>5</sup>/<sub>8</sub> inches (41 mm) thick with projecting dovetail webs on the back surface spaced approximately 8 inches (203 mm) o.c. The facing shall be tied to the backing wall with corrosion-resistant metal anchors of not less than No. 8 gage wire installed at the top of each piece in horizontal bed joints not less than 12 inches (305 mm) nor more than 18 inches (457 mm) o.c.; these anchors shall be secured to 1/4-inch (6.4 mm) corrosion-resistant pencil rods that pass through the vertical aligned loop anchors in the backing wall. The veneer ties shall have sufficient strength to support the full weight of the veneer in tension. The facing shall be set with not less than a 2-inch (51 mm) space from the backing wall and the space shall be filled solidly with Portland cement grout and pea gravel. Immediately prior to setting, the backing wall and the facing shall be drenched with clean water and shall be distinctly damp when the grout is poured.

**1405.10 Adhered masonry veneer.** Adhered masonry veneer shall comply with the applicable requirements in Section 1405.10 and Sections 6.1 and 6.3 of TMS 402/ACI 530/ASCE 5.

**1405.10.1 Exterior adhered masonry veneer.** Exterior adhered masonry veneer shall be installed in accordance with Section 1405.10 and in accordance with the manufacturer's instructions.

**1405.10.1.1 Water-resistive barriers.** Water-resistive barriers shall be installed as required in Section 2510.6.

**1405.10.1.2 Flashing at foundation.** A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48 mm) or 26 gauge galvanized or plastic with a minimum vertical attachment flange of 3<sup>1</sup>/<sub>2</sub> inches (89 mm) shall be installed to extend a minimum of 1 inch (25 mm) below the foundation plate line on exterior stud walls in accordance with Section 1405.4. The water-resistive barrier shall lap over the exterior of the attachment flange of the screed or flashing.

**1405.10.1.3 Clearances.** On exterior stud walls, adhered masonry veneer shall be installed a minimum of 4 inches (102 mm) above the earth, or a minimum of 2 inches (51 mm) above paved areas, or a minimum of 1/2 inch (12 mm) above exterior walking surfaces which are supported by the same foundation that supports the exterior wall.

**1405.10.2 Exterior adhered masonry veneers—porcelain tile.** Adhered units shall not exceed  $\frac{5}{8}$  inch (15.8 mm) thickness and a maximum of 24 inches (610 mm) in any face dimension nor more than 3 square feet (0.28 m<sup>2</sup>) in total face area and shall not weigh more than 9 pounds psf (0.43 kN/m<sup>2</sup>). Porcelain tile shall be adhered to an approved backing system.

**1405.10.3 Interior adhered masonry veneers.** Interior adhered masonry veneers shall have a maximum weight of 20 psf (0.958 kg/m<sup>2</sup>) and shall be installed in accordance with Section 1405.10. Where the interior adhered masonry veneer is supported by wood construction, the supporting members shall be designed to limit deflection to  $\frac{1}{600}$  of the span of the supporting members.

**1405.11 Metal veneers.** Veneers of metal shall be fabricated from approved corrosion-resistant materials or shall be protected front and back with porcelain enamel, or otherwise be treated to render the metal resistant to corrosion. Such veneers shall not be less than 0.0149-inch (0.378 mm) nominal thickness sheet steel mounted on wood or metal furring strips or approved sheathing on the wood construction.

**1405.11.1 Attachment.** Exterior metal veneer shall be securely attached to the supporting masonry or framing members with corrosion-resistant fastenings, metal ties or by other approved devices or methods. The spacing of the fastenings or ties shall not exceed 24 inches (610 mm) either vertically or horizontally, but where units exceed 4 square feet (0.4 m<sup>2</sup>) in area there shall be not less than four attachments per unit. The metal attachments shall have a cross-sectional area not less than provided by W 1.7 wire. Such attachments and their supports shall be capable of resisting a horizontal force in accordance with the wind loads specified in Section 1609, but in no case less than 20 psf (0.958 kg/m<sup>2</sup>).

**1405.11.2 Weather protection.** Metal supports for exterior metal veneer shall be protected by painting, galvanizing or by other equivalent coating or treatment. Wood studs, furring strips or other wood supports for exterior metal veneer shall be approved pressure-treated wood or protected as required in Section 1403.2. Joints and edges exposed to the weather shall be caulked with approved durable waterproofing material or by other approved means to prevent penetration of moisture.

**1405.11.3 Backup.** Masonry backup shall not be required for metal veneer except as is necessary to meet the fire-resistance requirements of this code.

**1405.11.4 Grounding.** Grounding of metal veneers on buildings shall comply with the requirements of Chapter 27 of this code.

**1405.12 Glass veneer.** The area of a single section of thin exterior structural glass veneer shall not exceed 10 square feet (0.93 m<sup>2</sup>) where it is not more than 15 feet (4572 mm) above the level of the sidewalk or grade level directly below, and shall not exceed 6 square feet (0.56 m<sup>2</sup>) where it is more than 15 feet (4572 mm) above that level.

**1405.12.1 Length and height.** The length or height of any section of thin exterior structural glass veneer shall not exceed 48 inches (1219 mm).

**1405.12.2 Thickness.** The thickness of thin exterior structural glass veneer shall be not less than 0.344 inch (8.7 mm).

**1405.12.3 Application.** Thin exterior structural glass veneer shall be set only after backing is thoroughly dry and after application of an approved bond coat uniformly over the entire surface of the backing so as to effectively seal the surface. Glass shall be set in place with an approved mastic cement in sufficient quantity so that at least 50 percent of the area of each glass unit is directly bonded to the backing by mastic not less than  $\frac{1}{4}$  inch (6.4 mm) thick and not more than  $\frac{5}{8}$  inch (15.9 mm) thick. The bond coat and mastic shall be evaluated for compatibility and shall bond firmly together.

**1405.12.4 Installation at sidewalk level.** Where glass extends to a sidewalk surface, each section shall rest in an approved metal molding, and be set at least  $\frac{1}{4}$  inch (6.4 mm) above the highest point of the sidewalk. The space between the molding and the sidewalk shall be thoroughly caulked and made water tight.

**1405.12.4.1 Installation above sidewalk level.** Where thin exterior structural glass veneer is installed above the level of the top of a bulkhead facing, or at a level more than 36 inches (914 mm) above the sidewalk level, the mastic cement binding shall be supplemented with approved nonferrous metal shelf angles located in the horizontal joints in every course. Such shelf angles shall be not less than 0.0478-inch (1.2 mm) thick and not less than 2 inches (51 mm) long and shall be spaced at approved intervals, with not less than two angles for each glass unit. Shelf angles shall be secured to the wall or backing with expansion bolts, toggle bolts or by other approved methods.

**1405.12.5 Joints.** Unless otherwise specifically approved by the building official, abutting edges of thin exterior structural glass veneer shall be ground square. Mitered joints shall not be used except where specifically approved for wide angles. Joints shall be uniformly buttered with an approved jointing compound and horizontal joints shall be held to not less than 0.063 inch (1.6 mm) by an approved nonrigid substance or device. Where thin exterior structural glass veneer abuts nonresilient material at sides or top, expansion joints not less than  $\frac{1}{4}$  inch (6.4 mm) wide shall be provided.

**1405.12.6 Mechanical fastenings.** Thin exterior structural glass veneer installed above the level of the heads of show windows and veneer installed more than 12 feet (3658 mm) above sidewalk level shall, in addition to the mastic cement and shelf angles, be held in place by the use of fastenings at each vertical or horizontal edge, or at the four corners of each glass unit. Fastenings shall be secured to the wall or backing with expansion bolts, toggle bolts or by other methods. Fastenings shall be so designed as to hold the glass veneer in a vertical plane independent of the

mastic cement. Shelf angles providing both support and fastenings shall be permitted.

**1405.12.7 Flashing.** Exposed edges of thin exterior structural glass veneer shall be flashed with overlapping corrosion-resistant metal flashing and caulked with a waterproof compound in a manner to effectively prevent the entrance of moisture between the glass veneer and the backing.

**1405.13 Exterior windows and doors.** Windows and doors installed in exterior walls shall conform to the testing and performance requirements of Section 1710.5.

**1405.13.1 Installation.** Windows and doors shall be installed in accordance with approved manufacturer's instructions. Fastener size and spacing shall be provided in such instructions and shall be calculated based on maximum loads and spacing used in the tests.

**1405.14 Vinyl siding.** Vinyl siding conforming to the requirements of this section and complying with ASTM D 3679 shall be permitted on exterior walls of buildings located in areas where  $V_{asd}$  as determined in accordance with Section 1609.3.1 does not exceed 100 miles per hour (45 m/s) and the building height is less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where  $V_{asd}$  as determined in accordance with Section 1609.3.1 exceeds 100 miles per hour (45 m/s), or building heights are in excess of 40 feet (12 192 mm), tests or calculations indicating compliance with Chapter 16 shall be submitted. Vinyl siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

**1405.14.1 Application.** The siding shall be applied over sheathing or materials listed in Section 2304.6. Siding shall be applied to conform with the water-resistive barrier requirements in Section 1403. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding and accessories shall have a minimum 0.313-inch (7.9 mm) head diameter and  $1/8$ -inch (3.18 mm) shank diameter. The nails shall be corrosion resistant and shall be long enough to penetrate the studs or nailing strip at least  $3/4$  inch (19 mm). Where the siding is installed horizontally, the fastener spacing shall not exceed 16 inches (406 mm) horizontally and 12 inches (305 mm) vertically. Where the siding is installed vertically, the fastener spacing shall not exceed 12 inches (305 mm) horizontally and 12 inches (305 mm) vertically.

**1405.15 Cement plaster.** Cement plaster applied to exterior walls shall conform to the requirements specified in Chapter 25.

**1405.16 Fiber-cement siding.** Fiber-cement siding complying with Section 1404.10 shall be permitted on exterior walls of Type I, II, III, IV and V construction for wind pressure resistance or wind speed exposures as indicated by the manufacturer's listing and label and approved installation instructions. Where specified, the siding shall be installed over sheathing or materials listed in Section 2304.6 and shall be

installed to conform to the water-resistive barrier requirements in Section 1403. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding to wood studs shall be corrosion-resistant round head smooth shank and shall be long enough to penetrate the studs at least 1 inch (25 mm). For metal framing, all-weather screws shall be used and shall penetrate the metal framing at least three full threads.

**1405.16.1 Panel siding.** Fiber-cement panels shall comply with the requirements of ASTM C 1186, Type A, minimum Grade II. Panels shall be installed with the long dimension either parallel or perpendicular to framing. Vertical and horizontal joints shall occur over framing members and shall be sealed with caulking, covered with battens or shall be designed to comply with Section 1403.2. Panel siding shall be installed with fasteners in accordance with the approved manufacturer's instructions.

**1405.16.2 Lap siding.** Fiber-cement lap siding having a maximum width of 12 inches (305 mm) shall comply with the requirements of ASTM C 1186, Type A, minimum Grade II. Lap siding shall be lapped a minimum of  $1\frac{1}{4}$  inches (32 mm) and lap siding not having tongue-and-groove end joints shall have the ends sealed with caulking, covered with an H-section joint cover, located over a strip of flashing or shall be designed to comply with Section 1403.2. Lap siding courses shall be installed with the fastener heads exposed or concealed in accordance with the approved manufacturer's instructions.

**1405.17 Fastening.** Weather boarding and wall coverings shall be securely fastened with aluminum, copper, zinc, zinc-coated or other approved corrosion-resistant fasteners in accordance with the nailing schedule in Table 2304.9.1 or the approved manufacturer's installation instructions. Shingles and other weather coverings shall be attached with appropriate standard-shingle nails to furring strips securely nailed to studs, or with approved mechanically bonding nails, except where sheathing is of wood not less than 1-inch (25 mm) nominal thickness or of wood structural panels as specified in Table 2308.9.3(3).

**1405.18 Polypropylene siding.** Polypropylene siding conforming to the requirements of this section and complying with Section 1404.12 shall be limited to exterior walls of Type VB construction located in areas where the wind speed specified in Chapter 16 does not exceed 100 miles per hour (45 m/s) and the building height is less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where the basic wind speed exceeds 100 miles per hour (45 m/s), or building heights are in excess of 40 feet (12 192 mm), tests or calculations indicating compliance with Chapter 16 shall be submitted. Polypropylene siding shall be installed in accordance with the manufacturer's installation instructions. Polypropylene siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

## SECTION 1406 COMBUSTIBLE MATERIALS ON THE EXTERIOR SIDE OF EXTERIOR WALLS

**1406.1 General.** Section 1406 shall apply to exterior wall coverings; balconies and similar projections; and bay and oriel windows constructed of combustible materials.

**1406.2 Combustible exterior wall coverings.** Combustible exterior wall coverings shall comply with this section.

**Exception:** Plastics complying with Chapter 26.

**1406.2.1 Type I, II, III and IV construction.** On buildings of Type I, II, III and IV construction, exterior wall coverings shall be permitted to be constructed of combustible materials, complying with the following limitations:

1. Combustible exterior wall coverings shall not exceed 10 percent of an exterior wall surface area where the fire separation distance is 5 feet (1524 mm) or less.
2. Combustible exterior wall coverings shall be limited to 40 feet (12 192 mm) in height above grade plane.
3. Combustible exterior wall coverings constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation shall not be limited in wall surface area where the fire separation distance is 5 feet (1524 mm) or less and shall be permitted up to 60 feet (18 288 mm) in height above grade plane regardless of the fire separation distance.
4. Wood veneers shall comply with Section 1405.5.

**1406.2.1.1 Ignition resistance.** Where permitted by Section 1406.2.1, combustible exterior wall coverings shall be tested in accordance with NFPA 268.

**Exceptions:**

1. Wood or wood-based products.
2. Other combustible materials covered with an exterior covering other than vinyl sidings listed in Table 1405.2.
3. Aluminum having a minimum thickness of 0.019 inch (0.48 mm).

**1406.2.1.1.1 Fire separation 5 feet or less.** Where installed on exterior walls having a fire separation distance of 5 feet (1524 mm) or less, combustible exterior wall coverings shall not exhibit sustained flaming as defined in NFPA 268.

**1406.2.1.1.2 Fire separation greater than 5 feet.** For fire separation distances greater than 5 feet (1524 mm), any exterior wall covering shall be permitted that has been exposed to a reduced level of incident radiant heat flux in accordance with the NFPA 268 test method without exhibiting sustained flaming. The minimum fire separation distance required for the exterior wall covering shall be determined from Table 1406.2.1.1.2 based on the maximum tolerable level of incident radiant heat flux that does not cause sustained flaming of the exterior wall covering.

**TABLE 1406.2.1.1.2  
MINIMUM FIRE SEPARATION FOR COMBUSTIBLE  
EXTERIOR WALL COVERINGS**

FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY(kW/m <sup>2</sup> )	FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY(kW/m <sup>2</sup> )
5	12.5	16	5.9
6	11.8	17	5.5
7	11.0	18	5.2
8	10.3	19	4.9
9	9.6	20	4.6
10	8.9	21	4.4
11	8.3	22	4.1
12	7.7	23	3.9
13	7.2	24	3.7
14	6.7	25	3.5
15	6.3		

For SI: 1 foot = 304.8 mm, 1 Btu/H<sup>2</sup> × °F = 0.0057 kW/m<sup>2</sup> × K.

**1406.2.2 Location.** Combustible exterior wall coverings located along the top of exterior walls shall be completely backed up by the exterior wall and shall not extend over or above the top of the exterior wall.

**1406.2.3 Fireblocking.** Where the combustible exterior wall covering is furred out from the exterior wall and forms a solid surface, the distance between the back of the exterior wall covering and the exterior wall shall not exceed 1<sup>5</sup>/<sub>8</sub> inches (41 mm). The concealed space thereby created shall be fireblocked in accordance with Section 718.

**Exception:** The distance between the back of the exterior wall covering and the exterior wall shall be permitted to exceed 15/8 inches (41 mm) where the concealed space is not required to be fireblocked by Section 718.

**1406.3 Balconies and similar projections.** Balconies and similar projections of combustible construction other than fire-retardant-treated wood shall be fire-resistance rated where required by Table 601 for floor construction or shall be of Type IV construction in accordance with Section 602.4. The aggregate length of the projections shall not exceed 50 percent of the building's perimeter on each floor.

**Exceptions:**

1. On buildings of Type I and II construction, three stories or less above grade plane, fire-retardant-treated wood shall be permitted for balconies, porches, decks and exterior stairways not used as required exits.
2. Untreated wood is permitted for pickets and rails or similar guardrail devices that are limited to 42 inches (1067 mm) in height.
3. Balconies and similar projections on buildings of Type III, IV and V construction shall be permitted to be of Type V construction, and shall not be required to have a fire-resistance rating where sprinkler protection is extended to these areas.

4. Where sprinkler protection is extended to the balcony areas, the aggregate length of the balcony on each floor shall not be limited.

**1406.4 Bay and oriel windows.** Bay and oriel windows shall conform to the type of construction required for the building to which they are attached.

**Exception:** Fire-retardant-treated wood shall be permitted on buildings three stories or less above grade plane of Type I, II, III or IV construction.

## SECTION 1407 METAL COMPOSITE MATERIALS (MCM)

**1407.1 General.** The provisions of this section shall govern the materials, construction and quality of metal composite materials (MCM) for use as exterior wall coverings in addition to other applicable requirements of Chapters 14 and 16.

**1407.1.1 Plastic core.** The plastic core of the MCM shall not contain foam plastic insulation as defined in Section 2602.1.

**1407.2 Exterior wall finish.** MCM used as exterior wall finish or as elements of balconies and similar projections and bay and oriel windows to provide cladding or weather resistance shall comply with Sections 1407.4 through 1407.14.

**1407.3 Architectural trim and embellishments.** MCM used as architectural trim or embellishments shall comply with Sections 1407.7 through 1407.14.

**1407.4 Structural design.** MCM systems shall be designed and constructed to resist wind loads as required by Chapter 16 for components and cladding.

**1407.5 Approval.** Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of Chapter 16 for wind loads.

**1407.6 Weather resistance.** MCM systems shall comply with Section 1403 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's installation instructions.

**1407.7 Durability.** MCM systems shall be constructed of approved materials that maintain the performance characteristics required in Section 1407 for the duration of use.

**1407.8 Fire-resistance rating.** Where MCM systems are used on exterior walls required to have a fire-resistance rating in accordance with Section 705, evidence shall be submitted to the building official that the required fire-resistance rating is maintained.

**Exception:** MCM systems not containing foam plastic insulation, which are installed on the outer surface of a fire-resistance-rated exterior wall in a manner such that the attachments do not penetrate through the entire exterior wall assembly, shall not be required to comply with this section.

**1407.9 Surface-burning characteristics.** Unless otherwise specified, MCM shall have a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in

the maximum thickness intended for use in accordance with ASTM E 84 or UL 723.

**1407.10 Type I, II, III and IV construction.** Where installed on buildings of Type I, II, III and IV construction, MCM systems shall comply with Sections 1407.10.1 through 1407.10.4, or Section 1407.11.

**1407.10.1 Surface-burning characteristics.** MCM shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723.

**1407.10.2 Thermal barriers.** MCM shall be separated from the interior of a building by an approved thermal barrier consisting of  $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

**1407.10.3 Thermal barrier not required.** The thermal barrier specified for MCM in Section 1407.10.2 is not required where:

1. The MCM system is specifically approved based on tests conducted in accordance with NFPA 286 and with the acceptance criteria of Section 803.1.2.1, UL 1040 or UL 1715. Such testing shall be performed with the MCM in the maximum thickness intended for use. The MCM system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The MCM is used as elements of balconies and similar projections, architectural trim or embellishments.

**1407.10.4 Full-scale tests.** The MCM system shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the MCM system with the MCM in the maximum thickness intended for use.

**1407.11 Alternate conditions.** MCM and MCM systems shall not be required to comply with Sections 1407.10.1 through 1407.10.4 provided such systems comply with Sections 1407.11.1, 1407.11.2, 1407.11.3, or 1407.11.4.

**1407.11.1 Installations up to 40 feet in height.** MCM shall not be installed more than 40 feet (12 190 mm) in height above grade where installed in accordance with Sections 1407.11.1.1 and 1407.11.1.2.

**1407.11.1.1 Fire separation distance of 5 feet or less.** Where the fire separation distance is 5 feet (1524 mm) or less, the area of MCM shall not exceed 10 percent of the exterior wall surface.

**1407.11.1.2 Fire separation distance greater than 5 feet.** Where the fire separation distance is greater than 5 feet (1524 mm), there shall be no limit on the area of exterior wall surface coverage using MCM.

**1407.11.2 Installations up to 50 feet in height.** MCM shall not be installed more than 50 feet (15 240 mm) in

## EXTERIOR WALLS

height above grade where installed in accordance with Sections 1407.11.2.1 and 1407.11.2.2.

**1407.11.2.1 Self-ignition temperature.** MCM shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.

**1407.11.2.2 Limitations.** Sections of MCM shall not exceed 300 square feet (27.9 m<sup>2</sup>) in area and shall be separated by a minimum of 4 feet (1219 mm) vertically.

**1407.11.3 Installations up to 75 feet in height (Option 1).** MCM shall not be installed more than 75 feet (22 860 mm) in height above grade plane where installed in accordance with Sections 1407.11.3.1 through 1407.11.3.5.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be exempt from the height limitation.

**1407.11.3.1 Prohibited occupancies.** MCM shall not be permitted on buildings classified as Group A-1, A-2, H, I-2 or I-3 occupancies.

**1407.11.3.2 Nonfire-resistance-rated exterior walls.** MCM shall not be permitted on exterior walls required to have a fire-resistance rating by other provisions of this code.

**1407.11.3.3 Specifications.** MCM shall be required to comply with all of the following:

1. MCM shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.
2. MCM shall conform to one of the following combustibility classifications when tested in accordance with ASTM D 635:

Class CC1: Materials that have a burning extent of 1 inch (25 mm) or less when tested at a nominal thickness of 0.060 inch (1.5 mm) or in the thickness intended for use.

Class CC2: Materials that have a burning rate of 2<sup>1</sup>/<sub>2</sub> inches per minute (1.06 mm/s) or less when tested at a nominal thickness of 0.060 inch (1.5 mm) or in the thickness intended for use.

**1407.11.3.4 Area limitation and separation.** The maximum area of a single MCM panel and the minimum vertical and horizontal separation requirements for MCM panels shall be as provided for in Table 1407.11.3.4. The maximum percentage of exterior wall area of any story covered with MCM panels shall not exceed that indicated in Table 1407.11.3.4 or the percentage of unprotected openings permitted by Section 705.8, whichever is smaller.

**Exception:** In buildings provided with flame barriers complying with Section 705.8.5 and extending 30 inches (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation shall not be required at the floor other than that provided by the vertical thickness of the flame barrier.

**1407.11.3.5 Automatic sprinkler system increases.** Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum percentage area of exterior wall of any story covered with MCM panels and the maximum square footage of a single area of MCM panels in Table 1407.11.3.4 shall be increased 100 percent. The area of MCM panels shall not exceed 50 percent of the exterior wall area of any story or the area permitted by Section 704.8 for unprotected openings, whichever is smaller.

**1407.11.4 Installations up to 75 feet in height (Option 2).** MCM shall not be installed more than 75 feet (22 860 mm) in height above grade plane where installed in accordance with Sections 1407.11.4.1 through 1407.11.4.4.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be exempt from the height limitation.

**TABLE 1407.11.3.4  
AREA LIMITATION AND SEPARATION REQUIREMENTS FOR MCM PANELS**

FIRE SEPARATION DISTANCE (feet)	COMBUSTIBILITY CLASS OF MCM	MAXIMUM PERCENTAGE AREA OF EXTERIOR WALL COVERED WITH MCM PANELS	MAXIMUM SINGLE AREA OF MCM PANELS (square feet)	MINIMUM SEPARATION OF MCM PANELS (feet)	
				Vertical	Horizontal
Less than 6	—	Not Permitted	Not Permitted	—	—
6 or more but less than 11	CC1	10	50	8	4
	CC2	Not Permitted	Not Permitted	—	—
11 or more but less than or equal to 30	CC1	25	90	6	4
	CC2	15	70	8	4
More than 30	CC1	50	Not Permitted	3 <sup>a</sup>	0
	CC2	50	100	6 <sup>a</sup>	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

a. For reductions in the minimum vertical separation, see Section 1407.11.3.4.



**1407.11.4.1 Minimum fire separation distance.** MCM shall not be installed on any wall with a fire separation distance less than 30 feet (9 144 mm).

**Exception:** Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the fire separation distance shall be permitted to be reduced to not less than 20 feet (6096 mm).

**1407.11.4.2 Specifications.** MCM shall be required to comply with all of the following:

1. MCM shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.
2. MCM shall conform to one of the following combustibility classifications when tested in accordance with ASTM D 635:

Class CC1: Materials that have a burning extent of 1 inch (25 mm) or less when tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use.

Class CC2: Materials that have a burning rate of  $2\frac{1}{2}$  inches per minute (1.06 mm/s) or less when tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use.

**1407.11.4.3 Area and size limitations.** The aggregate area of MCM panels shall not exceed 25 percent of the area of any exterior wall face of the story on which it is installed. The area of a single MCM panel installed above the first story above grade plane shall not exceed 16 square feet (1.5 m<sup>2</sup>) and the vertical dimension of a single MCM panel shall not exceed 4 feet (1219 mm).

**Exception:** Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum aggregate area of MCM panels shall be increased to 50 percent of the exterior wall face of the story on which it is installed and there shall not be a limit on the maximum dimension or area of a single MCM panel.

**1407.11.4.4 Vertical separations.** Flame barriers complying with Section 705.8 and extending 30 inches (762 mm) beyond the exterior wall or a vertical separation of not less than 4 feet (1219 mm) in height shall be provided to separate MCM panels located on the exterior walls at one story intervals.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**1407.12 Type V construction.** MCM shall be permitted to be installed on buildings of Type V construction.

**1407.13 Foam plastic insulation.** MCM systems containing foam plastic insulation shall also comply with the requirements of Section 2603.

**1407.14 Labeling.** MCM shall be labeled in accordance with Section 1703.5.

## SECTION 1408 EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

**1408.1 General.** The provisions of this section shall govern the materials, construction and quality of exterior insulation and finish systems (EIFS) for use as exterior wall coverings in addition to other applicable requirements of Chapters 7, 14, 16, 17 and 26.

**1408.2 Performance characteristics.** EIFS shall be constructed such that it meets the performance characteristics required in ASTM E 2568.

**1408.3 Structural design.** The underlying structural framing and substrate shall be designed and constructed to resist loads as required by Chapter 16.

**1408.4 Weather resistance.** EIFS shall comply with Section 1403 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's application instructions.

**1408.4.1 EIFS with drainage.** EIFS with drainage shall have an average minimum drainage efficiency of 90 percent when tested in accordance the requirements of ASTM E 2273 and is required on framed walls of Type V construction, Group R1, R2, R3 and R4 occupancies.

**1408.4.1.1 Water-resistive barrier.** For EIFS with drainage, the water-resistive barrier shall comply with Section 1404.2 or ASTM E 2570.

**1408.5 Installation.** Installation of the EIFS and EIFS with drainage shall be in accordance with the EIFS manufacturer's instructions.

**1408.6 Special inspections.** EIFS installations shall comply with the provisions of Sections 1704.2 and 1705.15.

## SECTION 1409 HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATES (HPL)

**1409.1 General.** The provisions of this section shall govern the materials, construction and quality of High-Pressure Decorative Exterior-Grade Compact Laminates (HPL) for use as exterior wall coverings in addition to other applicable requirements of Chapters 14 and 16.

**1409.2 Exterior wall finish.** HPL used as exterior wall covering or as elements of balconies and similar projections and bay and oriel windows to provide cladding or weather resistance shall comply with Sections 1409.4 and 1409.14.

**1409.3 Architectural trim and embellishments.** HPL used as architectural trim or embellishments shall comply with Sections 1409.7 through 1409.14.

**1409.4 Structural design.** HPL systems shall be designed and constructed to resist wind loads as required by Chapter 16 for components and cladding.

**1409.5 Approval.** Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of Chapter 16 for wind loads.

**1409.6 Weather resistance.** HPL systems shall comply with Section 1403 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's installation instructions.

**1409.7 Durability.** HPL systems shall be constructed of approved materials that maintain the performance characteristics required in Section 1409 for the duration of use.

**1409.8 Fire-resistance rating.** Where HPL systems are used on exterior walls required to have a fire-resistance rating in accordance with Section 705, evidence shall be submitted to the building official that the required fire-resistance rating is maintained.

**Exception:** HPL systems not containing foam plastic insulation, which are installed on the outer surface of a fire-resistance-rated exterior wall in a manner such that the attachments do not penetrate through the entire exterior wall assembly, shall not be required to comply with this section.

**1409.9 Surface-burning characteristics.** Unless otherwise specified, HPL shall have a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in the minimum and maximum thicknesses intended for use in accordance with ASTM E 84 or UL 723.

**1409.10 Type I, II, III and IV construction.** Where installed on buildings of Type I, II, III and IV construction, HPL systems shall comply with Sections 1409.10.1 through 1409.10.4, or Section 1409.11.

**1409.10.1 Surface-burning characteristics.** HPL shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in the minimum and maximum thicknesses intended for use in accordance with ASTM E 84 or UL 723.

**1409.10.2 Thermal barriers.** HPL shall be separated from the interior of a building by an approved thermal barrier consisting of  $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more than 250°F (121°C) after 15 minutes of fire exposure in accordance with the standard time-temperature curve of ASTM E 119 or UL 263. The thermal barrier shall be installed in such a manner that it will remain in place for not less than 15 minutes based on a test conducted in accordance with UL 1715.

**1409.10.3 Thermal barrier not required.** The thermal barrier specified for HPL in Section 1409.10.2 is not required where:

1. The HPL system is specifically approved based on tests conducted in accordance with UL 1040 or UL 1715. Such testing shall be performed with the HPL in the minimum and maximum thicknesses intended for use. The HPL system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The HPL is used as elements of balconies and similar projections, architectural trim or embellishments.

**1409.10.4 Full-scale tests.** The HPL system shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the HPL system with the HPL in the minimum and maximum thicknesses intended for use.

**1409.11 Alternate conditions.** HPL and HPL systems shall not be required to comply with Sections 1409.10.1 through 1409.10.4 provided such systems comply with Section 1409.11.1 or 1409.11.2.

**1409.11.1 Installations up to 40 feet in height.** HPL shall not be installed more than 40 feet (12 190 mm) in height above grade plane where installed in accordance with Sections 1409.11.1.1 and 1409.11.1.2.

**1409.11.1.1 Fire separation distance of 5 feet or less.** Where the fire separation distance is 5 feet (1524 mm) or less, the area of HPL shall not exceed 10 percent of the exterior wall surface.

**1409.11.1.2 Fire separation distance greater than 5 feet.** Where the fire separation distance is greater than 5 feet (1524 mm), there shall be no limit on the area of exterior wall surface coverage using HPL.

**1409.11.2 Installations up to 50 feet in height.** HPL shall not be installed more than 50 feet (15 240 mm) in height above grade plane where installed in accordance with Sections 1409.11.2.1 and 1409.11.2.2.

**1409.11.2.1 Self-ignition temperature.** HPL shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.

**1409.11.2.2 Limitations.** Sections of HPL shall not exceed 300 square feet (27.9 m<sup>2</sup>) in area and shall be separated by a minimum 4 feet (1219 mm) vertically.

**1409.12 Type V construction.** HPL shall be permitted to be installed on buildings of Type V construction.

**1409.13 Foam plastic insulation.** HPL systems containing foam plastic insulation shall also comply with the requirements of Section 2603.

**1409.14 Labeling.** HPL shall be labeled in accordance with Section 1703.5.

## SECTION 1410 [DSA-SS & DSA-SS/CC, OSHPD 1, 2 & 4] ADDITIONAL REQUIREMENTS FOR ANCHORED AND ADHERED VENEER

**1410.1 General.** *In no case shall veneer be considered as part of the backing in computing strength or deflection nor shall it be considered a part of the required thickness of the backing.*

*Veneer shall be anchored in a manner which will not allow relative movement between the veneer and the wall.*

*Anchored or adhered veneer shall not be used on overhead horizontal surfaces.*

**1410.2 Adhered veneer.** *Units of tile, masonry, stone or terra cotta which exceed  $\frac{5}{8}$  inch (16 mm) in thickness shall be applied as for anchored veneer where used over exit ways or*

*more than 20 feet (6096 mm) in height above adjacent ground elevation.*

**1410.2.1 Bond strength and tests.** *Veneer shall develop a bond to the backing in accordance with TMS 402, Section 6.3.2.4.*

*Not less than two shear tests shall be performed for the adhered veneer between the units and the supporting element. At least one shear test shall be performed at each building for each 5,000 square feet (465 m<sup>2</sup>) of floor area or fraction thereof.*



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 15 – ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				
Adopt entire chapter as amended (amended sections listed below)	X						X	X	X	X		X								
Adopt only those sections that are listed below		X																		
Chapter / Section																				
1501		X																		
1502		X																		
1505		X																		
Table 1505.1		X																		
1505.8		X																		
1505.9		X																		
1506		X																		
1507		X																		
1507.3.10							X	X	X	X		X								
1507.7.8							X	X	X	X		X								
1509		X																		
1509.7.1 Exception	X		X	X			X	X												
1509.7.2		X																		
1511		X																		
1511.1		X																		
1511.1.1		X																		
1512							X	X	X	X		X								

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 111.*



## CHAPTER 15

# ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

### SECTION 1501 GENERAL

**1501.1 Scope.** The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

### SECTION 1502 DEFINITIONS

**1502.1 Definitions.** The following terms are defined in Chapter 2:

**AGGREGATE.**

**BALLAST.**

**BUILT-UP ROOF COVERING.**

**INTERLAYMENT.**

**MECHANICAL EQUIPMENT SCREEN.**

**METAL ROOF PANEL.**

**METAL ROOF SHINGLE.**

**MODIFIED BITUMEN ROOF COVERING.**

**PENTHOUSE.**

**PHOTOVOLTAIC MODULES/SHINGLES.**

**POSITIVE ROOF DRAINAGE.**

**REROOFING.**

**ROOF ASSEMBLY.**

**ROOF COVERING.**

**ROOF COVERING SYSTEM.**

**ROOF DECK.**

**ROOF RECOVER.**

**ROOF REPAIR.**

**ROOF REPLACEMENT.**

**ROOF VENTILATION.**

**ROOFTOP STRUCTURE.**

**SCUPPER.**

**SINGLE-PLY MEMBRANE.**

**UNDERLAYMENT.**

### SECTION 1503 WEATHER PROTECTION

**1503.1 General.** Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed and installed in accordance with this code and the approved manufacturer's instructions such that the roof covering shall serve to protect the building or structure.

**1503.2 Flashing.** Flashing shall be installed in such a manner so as to prevent moisture entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

**1503.2.1 Locations.** Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.483 mm) (No. 26 galvanized sheet).

**1503.3 Coping.** Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall.

**[P] 1503.4 Roof drainage.** Design and installation of roof drainage systems shall comply with Section 1503 of this code and *Chapter 11 of the California Plumbing Code*.

**[P] 1503.4.1 Secondary (emergency overflow) drains or scuppers.** Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with *Chapter 11 of the California Plumbing Code*.

**1503.4.2 Scuppers.** When scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

**1503.4.3 Gutters.** Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or a minimum of Schedule 40 plastic pipe.

**1503.5 Roof ventilation.** Intake and exhaust vents shall be provided in accordance with Section 1203.2 and the manufacturer's installation instructions.

**1503.6 Crickets and saddles.** A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

**Exception:** Unit skylights installed in accordance with Section 2405.5 and flashed in accordance with the manu-

facturer's instructions shall be permitted to be installed without a cricket or saddle.

## SECTION 1504 PERFORMANCE REQUIREMENTS

**1504.1 Wind resistance of roofs.** Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

**1504.1.1 Wind resistance of asphalt shingles.** Asphalt shingles shall comply with Section 1507.2.7.

**1504.2 Wind resistance of clay and concrete tile.** Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.5.

**1504.3 Wind resistance of nonballasted roofs.** Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.

**1504.3.1 Other roof systems.** Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4474, UL 580 or UL 1897.

**1504.3.2 Metal panel roof systems.** Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592.

**Exception:** Metal roofs constructed of cold-formed steel, where the roof deck acts as the roof covering and provides both weather protection and support for structural loads, shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2210.1.

**1504.4 Ballasted low-slope roof systems.** Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with Section 1504.8 and ANSI/SPRI RP-4.

**1504.5 Edge securement for low-slope roofs.** Low-slope built-up, modified bitumen and single-ply roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except  $V_{ult}$  wind speed shall be determined from Figure 1609A, 1609B, or 1609C as applicable.

**1504.6 Physical properties.** Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G 152, ASTM G 155 or ASTM G 154. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of ten-

sile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.

**1504.7 Impact resistance.** Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37-GP-52M or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470.

**1504.8 Aggregate.** Aggregate used as surfacing for roof coverings and aggregate, gravel or stone used as ballast shall not be used on the roof of a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site.

**TABLE 1504.8  
MAXIMUM ALLOWABLE MEAN ROOF HEIGHT PERMITTED  
FOR BUILDINGS WITH AGGREGATE ON THE ROOF IN  
AREAS OUTSIDE A HURRICANE-PRONE REGION**

NOMINAL DESIGN WIND SPEED, $V_{asd}$ (mph) <sup>b, d</sup>	MAXIMUM MEAN ROOF HEIGHT (ft) <sup>a, c</sup>		
	Exposure category		
	B	C	D
85	170	60	30
90	110	35	15
95	75	20	NP
100	55	15	NP
105	40	NP	NP
110	30	NP	NP
115	20	NP	NP
120	15	NP	NP
Greater than 120	NP	NP	NP

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Mean roof height as defined in ASCE 7.

b. For intermediate values of  $V_{asd}$ , the height associated with the next higher value of  $V_{asd}$  shall be used, or direct interpolation is permitted.

c. NP = gravel and stone not permitted for any roof height.

d.  $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

## SECTION 1505 FIRE CLASSIFICATION

**1505.1 General.** Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

**Exception:** Skylights and sloped glazing that comply with Chapter 24 or Section 2610.



**TABLE 1505.1<sup>a</sup>**  
**MINIMUM ROOF COVERING**  
**CLASSIFICATION FOR TYPES OF CONSTRUCTION**

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C	B	C	B	B	C

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

a. Unless otherwise required in accordance with Chapter 7A.

**1505.1.1 Roof coverings within very high fire hazard severity zones.** The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class A.

**Exception:** The requirements shall not apply in any jurisdiction that adopts the model ordinance approved by the State Fire Marshal pursuant to Section 51189 of the Government Code or an ordinance that substantially conforms to the model ordinance and transmits a copy to the State Fire Marshal.

**1505.1.2 Roof coverings within state responsibility areas.** The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure shall be a fire-retardant roof covering that is at least Class B.

**Exception:** Areas designated as moderate fire hazard severity zones.

**1505.1.3 Roof coverings within all other areas.** The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class C.

**1505.1.4 Roofing requirements in a Wildland-Urban Interface Fire Area.** Roofing requirements for structures located in a Wildland-Urban Interface Fire Area shall also comply with Section 705A.

**1505.2 Class A roof assemblies.** Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

**Exceptions:**

1. Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles,

clay or concrete roof tile or slate installed on non-combustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.

3. Class A roof assemblies include minimum 16 oz/sq. ft. (0.0416 kg/m<sup>2</sup>) copper sheets installed over combustible decks.

**1505.3 Class B roof assemblies.** Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

**1505.4 Class C roof assemblies.** Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

**1505.5 Nonclassified roofing.** Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

**1505.6 Fire-retardant-treated wood shingles and shakes.** Fire-retardant-treated wood shakes and shingles are wood shakes and shingles complying with UBC Standard 15-3 or 15-4 which are impregnated by the full-cell vacuum-pressure process with fire-retardant chemicals, and which have been qualified by UBC Standard 15-2 for use on Class A, B or C roofs.

Fire-retardant-treated wood shakes and shingles shall comply with ICC-ES EG107 and with the weathering requirements contained in Health and Safety Code Section 13132.7(j). Each bundle shall bear labels from an ICC accredited quality control agency identifying their roof-covering classification and indicating their compliance with ICC-ES EG107 and with the weathering requirements contained in Health and Safety Code Section 13132.7(j).

Health and Safety Code Section 13132.7(j). No wood roof covering materials shall be sold or applied in this state unless both of the following conditions are met:

- (1) The materials have been approved and listed by the State Fire Marshal as complying with the requirements of this section.
- (2) The materials have passed at least five years of the 10-year natural weathering test. The 10-year natural weathering test required by this subdivision shall be conducted in accordance with standard 15-2 of the 1994 edition of the Uniform Building Code at a testing facility recognized by the State Fire Marshal.

**1505.7 Special purpose roofs.** Special purpose wood shingle or wood shake roofing shall conform with the grading and application requirements of Section 1507.8 or 1507.9. In addition, an underlayment of <sup>5</sup>/<sub>8</sub>-inch (15.9 mm) Type X water-resistant gypsum backing board or gypsum sheathing shall be placed under minimum nominal <sup>1</sup>/<sub>2</sub>-inch-thick (12.7 mm) wood structural panel solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

**1505.8 Building integrated photovoltaic systems.** Rooftop installed building integrated photovoltaic systems that serve

as the roof covering shall be *listed and labeled* for fire classification in accordance with Section 1505.1.

**1505.9 Photovoltaic panels and modules.** Rooftop mounted photovoltaic systems shall be tested, listed and identified with a fire classification in accordance with UL 1703. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

## SECTION 1506 MATERIALS

**1506.1 Scope.** The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

**1506.2 Compatibility of materials.** Roofs and roof coverings shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

**1506.3 Material specifications and physical characteristics.** Roof-covering materials shall conform to the applicable standards listed in this chapter. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved agency shall be required by the building code official to determine the character, quality and limitations of application of the materials.

**1506.4 Product identification.** Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

## SECTION 1507 REQUIREMENTS FOR ROOF COVERINGS

**1507.1 Scope.** Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.

**1507.2 Asphalt shingles.** The installation of asphalt shingles shall comply with the provisions of this section.

**1507.2.1 Deck requirements.** Asphalt shingles shall be fastened to solidly sheathed decks.

**1507.2.2 Slope.** Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) up to four units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.2.8.

**1507.2.3 Underlayment.** Unless otherwise noted, required underlayment shall conform to ASTM D 226, Type I, ASTM D 4869, Type I, or ASTM D 6757.

**1507.2.4 Self-adhering polymer modified bitumen sheet.** Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

**1507.2.5 Asphalt shingles.** Asphalt shingles shall comply with ASTM D 225 or ASTM D 3462.

**1507.2.6 Fasteners.** Fasteners for asphalt shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (2.67 mm)] shank with a minimum  $\frac{3}{8}$  inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than  $\frac{3}{4}$  inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

**1507.2.7 Attachment.** Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), shingles shall be installed as required by the manufacturer.

**1507.2.7.1 Wind resistance.** Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table 1507.2.7.1(1) for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D 7158 and the required classification in Table 1507.2.7.1(1).

**Exception:** Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and labeled to indicate compliance with ASTM D 3161 and the required classification in Table 1507.2.7.1(2).

TABLE 1507.2.7.1(1)  
CLASSIFICATION OF ASPHALT  
ROOF SHINGLES PER ASTM D 7158<sup>a</sup>

NOMINAL DESIGN WIND SPEED, $V_{asd}^b$ (mph)	CLASSIFICATION REQUIREMENT
85	D, G or H
90	D, G or H
100	G or H
110	G or H
120	G or H
130	H
140	H
150	H

For SI: 1 foot = 304.8 mm; 1 mph = 0.447 m/s.

a. The standard calculations contained in ASTM D 7158 assume exposure category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

b.  $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

**TABLE 1507.2.7.1(2)**  
**CLASSIFICATION OF ASPHALT SHINGLES PER ASTM D 3161**

NOMINAL DESIGN WIND SPEED, $V_{asd}$ <sup>a</sup> (mph)	CLASSIFICATION REQUIREMENT
85	A, D or F
90	A, D or F
100	A, D or F
110	F
120	F
130	F
140	F
150	F

For SI: 1 mph = 0.447 m/s.

a.  $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

**1507.2.8 Underlayment application.** For roof slopes from two units vertical in 12 units horizontal (17-percent slope) and up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be two layers applied in the following manner. Apply a minimum 19-inch-wide (483 mm) strip of underlayment felt parallel with and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment overlapping successive sheets 19 inches (483 mm), by fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal.

**1507.2.8.1 High wind attachment.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap at a maximum spacing of 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$  in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section 1507.2.8 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof

sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.2.8.2 Ice barrier.** In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

**Exception:** Detached accessory structures that contain no conditioned floor area.

**1507.2.9 Flashings.** Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer's printed instructions.

**1507.2.9.1 Base and cap flashing.** Base and cap flashing shall be installed in accordance with the manufacturer's instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness or mineral-surfaced roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m<sup>2</sup>). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness.

**1507.2.9.2 Valleys.** Valley linings shall be installed in accordance with the manufacturer's instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys (valley lining exposed) lined with metal, the valley lining shall be at least 24 inches (610 mm) wide and of any of the corrosion-resistant metals in Table 1507.2.9.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing complying with ASTM D 3909 or ASTM D 6380 shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer a minimum of 36 inches (914 mm) wide.
3. For closed valleys (valleys covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 6380, and at least 36 inches (914 mm) wide or types as described in Item 1 or 2 above shall be permitted. Self-adhering polymer modified bitumen underlayment complying with ASTM D 1970 shall be permitted in lieu of the lining material.

**1507.2.9.3 Drip edge.** Provide drip edge at eaves and gables of shingle roofs. Overlap to be a minimum of 2 inches (51 mm). Eave drip edges shall extend  $\frac{1}{4}$  inch (6.4 mm) below sheathing and extend back on the roof a minimum of 2 inches (51 mm). Drip edge shall be mechanically fastened a maximum of 12 inches (305 mm) o.c.

**TABLE 1507.2.9.2  
VALLEY LINING MATERIAL**

MATERIAL	MINIMUM THICKNESS	GAGE	WEIGHT
Aluminum	0.024 in.	—	—
Cold-rolled copper	0.0216 in.	—	ASTM B 370, 16 oz. per square ft.
Copper	—	—	16 oz
Galvanized steel	0.0179 in.	26 (zinc-coated G90)	—
High-yield copper	0.0162 in.	—	ASTM B 370, 12 oz. per square ft.
Lead	—	—	2.5 pounds
Lead-coated copper	0.0216 in.	—	ASTM B 101, 16 oz. per square ft.
Lead-coated high-yield copper	0.0162 in.	—	ASTM B 101, 12 oz. per square ft.
Painted terne	—	—	20 pounds
Stainless steel	—	28	—
Zinc alloy	0.027 in.	—	—

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg, 1 ounce = 28.35 g, 1 square foot = 0.093 m<sup>2</sup>.

**1507.3 Clay and concrete tile.** The installation of clay and concrete tile shall comply with the provisions of this section.

**1507.3.1 Deck requirements.** Concrete and clay tile shall be installed only over solid sheathing or spaced structural sheathing boards.

**1507.3.2 Deck slope.** Clay and concrete roof tile shall be installed on roof slopes of 2½ units vertical in 12 units horizontal (21-percent slope) or greater. For roof slopes from 2½ units vertical in 12 units horizontal (21-percent slope) to four units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.3.3.

**1507.3.3 Underlayment.** Unless otherwise noted, required underlayment shall conform to: ASTM D 226, Type II; ASTM D 2626 or ASTM D 6380, Class M mineral-surfaced roll roofing.

**1507.3.3.1 Low-slope roofs.** For roof slopes from 2½ units vertical in 12 units horizontal (21-percent slope), up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be a minimum of two layers applied as follows:

1. Starting at the eave, a 19-inch (483 mm) strip of underlayment shall be applied parallel with the eave and fastened sufficiently in place.
2. Starting at the eave, 36-inch-wide (914 mm) strips of underlayment felt shall be applied overlapping successive sheets 19 inches (483 mm) and fastened sufficiently in place.

**1507.3.3.2 High-slope roofs.** For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to, and starting from the eaves and lapped 2 inches (51 mm), fastened only as necessary to hold in place.

**1507.3.3.3 High wind attachment.** Underlayment applied in areas subject to high wind [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with

Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$  in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Sections 1507.3.3.1 and 1507.3.3.2 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of ¾ inch (19.1 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.3.4 Clay tile.** Clay roof tile shall comply with ASTM C 1167.

**1507.3.5 Concrete tile.** Concrete roof tile shall comply with ASTM C 1492.

**1507.3.6 Fasteners.** Tile fasteners shall be corrosion resistant and not less than 11 gage, ⅝-inch (8.0 mm) head, and of sufficient length to penetrate the deck a minimum of ¾ inch (19.1 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914 mm) from either side of hips or ridges and edges of eaves and gable rakes.

**1507.3.7 Attachment.** Clay and concrete roof tiles shall be fastened in accordance with Table 1507.3.7.

**TABLE 1507.3.7**  
**CLAY AND CONCRETE TILE ATTACHMENT<sup>a, b, c</sup>**

GENERAL - CLAY OR CONCRETE ROOF TILE				
Maximum Nominal Design Wind Speed, $V_{asd}$ <sup>f</sup> (mph)	Mean roof height (feet)	Roof slope < 3:12	Roof slope 3:12 and over	
85	0-60	One fastener per tile. Flat tile without vertical laps, two fasteners per tile.	Two fasteners per tile. Only one fastener on slopes of 7:12 and less for tiles with installed weight exceeding 7.5 lbs./sq. ft. having a width no greater than 16 inches.	
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS <sup>d, e</sup> (Installations on spaced/solid sheathing with battens or spaced sheathing)				
Maximum Nominal Design Wind Speed, $V_{asd}$ <sup>f</sup> (mph)	Mean roof height (feet)	Roof slope < 5:12	Roof slope 5:12 < 12:12	Roof slope 12:12 and over
85	0-60	Fasteners are not required. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener per tile every other row. All perimeter tiles require one fastener. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener required for every tile. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS (Installations on solid sheathing without battens)				
Maximum Nominal Design Wind Speed, $V_{asd}$ <sup>f</sup> (mph)	Mean roof height (feet)	All roof slopes		
85	0-60	One fastener per tile.		
100	0-40	One fastener per tile.		
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 4.882 kg/m<sup>2</sup>.

- Minimum fastener size. Corrosion-resistant nails not less than No. 11 gage with  $\frac{5}{16}$ -inch head. Fasteners shall be long enough to penetrate into the sheathing  $\frac{3}{4}$  inch or through the thickness of the sheathing, whichever is less. Attaching wire for clay and concrete tile shall not be smaller than 0.083 inch.
- Snow areas. A minimum of two fasteners per tile are required on battens and one fastener.
- Roof slopes greater than 24:12. The nose of all tiles shall be securely fastened.
- Horizontal battens. Battens shall be not less than 1 inch by 2 inch nominal. Provisions shall be made for drainage by a minimum of  $\frac{1}{8}$ -inch riser at each nail or by 4-foot-long battens with at least a  $\frac{1}{2}$ -inch separation between battens. Horizontal battens are required for slopes over 7:12.
- Perimeter fastening areas include three tile courses but not less than 36 inches from either side of hips or ridges and edges of eaves and gable rakes.
- $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

**1507.3.8 Application.** Tile shall be applied according to the manufacturer's installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

**1507.3.9 Flashing.** At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley, or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

**1507.3.10 Additional requirements.** [DSA-SS& DSA-SS/CC, OSHPD 1, 2 &4] In addition to the requirements of 1507.3.6 and 1507.3.7, the installation of clay and concrete tile roof coverings shall comply with seismic anchorage provisions of Section 1512.

**1507.4 Metal roof panels.** The installation of metal roof panels shall comply with the provisions of this section.

**1507.4.1 Deck requirements.** Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

**1507.4.2 Deck slope.** Minimum slopes for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25-percent slope).
2. The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be one-half unit vertical in 12 units horizontal (4-percent slope). Lap sealants shall be applied in accordance with the approved manufacturer's installation instructions.
3. The minimum slope for standing seam of roof systems shall be one-quarter unit vertical in 12 units horizontal (2-percent slope).

**1507.4.3 Material standards.** Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3(1). The materials used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table 1507.4.3(2).

**TABLE 1507.4.3(1)  
METAL ROOF COVERINGS**

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
Cold-rolled copper	ASTM B 370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems: 12 oz./sq. ft. for pre-formed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A 653 G-90 zinc-coated <sup>a</sup> .
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B 101
Prepainted steel	ASTM A 755
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A 240, 300 Series Alloys
Steel	ASTM A 924
Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.0026 kg/m<sup>2</sup>,  
1 pound per square foot = 4.882 kg/m<sup>2</sup>,  
1 inch = 25.4 mm, 1 pound = 0.454 kg.

- a. For Group U buildings, the minimum coating thickness for ASTM A 653 galvanized steel roofing shall be G-60.

**TABLE 1507.4.3(2)  
MINIMUM CORROSION RESISTANCE**

55% Aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
5% Aluminum alloy-coated steel	ASTM A 875 GF60
Aluminum-coated steel	ASTM A 463 T2 65
Galvanized steel	ASTM A 653 G-90
Prepainted steel	ASTM A 755 <sup>a</sup>

- a. Paint systems in accordance with ASTM A 755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A 792, ASTM A 875, ASTM A 463 or ASTM A 653.

**1507.4.4 Attachment.** Metal roof panels shall be secured to the supports in accordance with the approved manufacturer's fasteners. In the absence of manufacturer recommendations, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. Copper, brass, bronze, copper alloy or 300 series stainless-steel fasteners shall be used for copper roofs.
3. Stainless-steel fasteners are acceptable for all types of metal roofs.

**1507.4.5 Underlayment and high wind.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$  in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instructions except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.5 Metal roof shingles.** The installation of metal roof shingles shall comply with the provisions of this section.

**1507.5.1 Deck requirements.** Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

**1507.5.2 Deck slope.** Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

**1507.5.3 Underlayment.** Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

**1507.5.3.1 Underlayment and high wind.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$  in accordance with Section 1609.3.1, equals or exceeds 120 mph (54

m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch spacing (152 mm) at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instructions except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.5.4 Ice barrier.** In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

**Exception:** Detached accessory structures that contain no conditioned floor area.

**1507.5.5 Material standards.** Metal roof shingle roof coverings shall comply with Table 1507.4.3(1). The materials used for metal-roof shingle roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses specified in the standards listed in Table 1507.4.3(2).

**1507.5.6 Attachment.** Metal roof shingles shall be secured to the roof in accordance with the approved manufacturer's installation instructions.

**1507.5.7 Flashing.** Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3(1). The valley flashing shall extend at least 8 inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than  $\frac{3}{4}$  inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it consisting of either one layer of underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to underlayment required for metal roof shingles. The metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for roof slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

**1507.6 Mineral-surfaced roll roofing.** The installation of mineral-surfaced roll roofing shall comply with this section.

**1507.6.1 Deck requirements.** Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

**1507.6.2 Deck slope.** Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

**1507.6.3 Underlayment.** Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

**1507.6.3.1 Underlayment and high wind.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$ , in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instructions except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.6.4 Ice barrier.** In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

**Exception:** Detached accessory structures that contain no conditioned floor area.

**1507.6.5 Material standards.** Mineral-surfaced roll roofing shall conform to ASTM D 3909 or ASTM D 6380.

**1507.7 Slate shingles.** The installation of slate shingles shall comply with the provisions of this section.

**1507.7.1 Deck requirements.** Slate shingles shall be fastened to solidly sheathed roofs.

**1507.7.2 Deck slope.** Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

**1507.7.3 Underlayment.** Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

**1507.7.3.1 Underlayment and high wind.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$ , in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instructions except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.7.4 Ice barrier.** In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

**Exception:** Detached accessory structures that contain no conditioned floor area.

**1507.7.5 Material standards.** Slate shingles shall comply with ASTM C 406.

**1507.7.6 Application.** Minimum headlap for slate shingles shall be in accordance with Table 1507.7.6. Slate shingles shall be secured to the roof with two fasteners per slate.

**TABLE 1507.7.6  
SLATE SHINGLE HEADLAP**

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope ≥ 20:12	2

For SI: 1 inch = 25.4 mm.

**1507.7.7 Flashing.** Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be a minimum of 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc-coated G90. Chimneys, stucco or brick walls shall have a minimum of two plies of felt for a cap flashing consisting of a 4-inch-wide (102 mm) strip of



felt set in plastic cement and extending 1 inch (25 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing 2 inches (51 mm).

**1507.7.8 Additional requirements.** [DSA-SS & DSA-SS/CC, OSHPD 1, 2 & 4] In addition to the requirements of Sections 1507.7.5, the installation of slate shingle roof coverings shall comply with the requirements of Section 1507.3.6 and 1507.3.7, and the seismic anchorage provisions of Section 1512.

**1507.8 Wood shingles.** The installation of wood shingles shall comply with the provisions of this section and Table 1507.8.

**1507.8.1 Deck requirements.** Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

**TABLE 1507.8  
WOOD SHINGLE AND SHAKE INSTALLATION**

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (3:12) or greater.	Wood shakes shall be installed on slopes of four units vertical in 12 units horizontal (4:12) or greater.
2. Deck requirement		
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1" × 4" nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1" × 4" nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners. When 1" × 4" spaced sheathing is installed at 10 inches, boards must be installed between the sheathing boards.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water.	Solid sheathing required.	Solid sheathing is required.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D 226, Type 1.
4. Underlayment		
Temperate climate	Underlayment shall comply with ASTM D 226, Type 1.	Underlayment shall comply with ASTM D 226, Type 1.
In areas where there is a possibility of ice forming along the eaves causing a backup of water.	An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.	An ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the lowest edges of all roof surfaces to a point at least 24 inches inside the exterior wall line of the building.
5. Application		
Attachment	Fasteners for wood shingles shall be hot-dipped galvanized or Type 304 (Type 316 for coastal areas) stainless steel with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be hot-dipped galvanized or Type 304 (Type 316 for coastal areas) with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.7.	Weather exposures shall not exceed those set forth in Table 1507.9.8.
Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch for preservative-treated taper sawn shakes.
Flashing	In accordance with Section 1507.8.8.	In accordance with Section 1507.9.9.

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

**1507.8.1.1 Solid sheathing required.** Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

**1507.8.2 Deck slope.** Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25-percent slope) or greater.

**1507.8.3 Underlayment.** Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

**1507.8.3.1 Underlayment and high wind.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$  in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instructions except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.8.4 Ice barrier.** In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

**Exception:** Detached accessory structures that contain no conditioned floor area.

**1507.8.5 Material standards.** Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.5.

**TABLE 1507.8.5  
WOOD SHINGLE MATERIAL REQUIREMENTS**

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB = Cedar Shake and Shingle Bureau

**1507.8.6 Attachment.** Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of  $\frac{3}{4}$  inch (19.1 mm) into the sheathing. For sheathing less than  $\frac{1}{2}$  inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with a minimum of two fasteners.

**1507.8.7 Application.** Wood shingles shall be laid with a side lap not less than  $1\frac{1}{2}$  inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be  $\frac{1}{4}$  to  $\frac{3}{8}$  inches (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.7.

**TABLE 1507.8.7  
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3.75	5
		No. 2	3.5	4
		No. 3	3	3.5
	18	No. 1	4.25	5.5
		No. 2	4	4.5
		No. 3	3.5	4
	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

For SI: 1 inch = 25.4 mm.

**1507.8.8 Flashing.** At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

**1507.9 Wood shakes.** The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

**1507.9.1 Deck requirements.** Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to

coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) o.c., additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

**1507.9.1.1 Solid sheathing required.** Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

**1507.9.2 Deck slope.** Wood shakes shall only be used on slopes of four units vertical in 12 units horizontal (33-percent slope) or greater.

**1507.9.3 Underlayment.** Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

**1507.9.3.1 Underlayment and high wind.** Underlayment applied in areas subject to high winds [ $V_{asd}$  greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where  $V_{asd}$  in accordance with Section 1609.3.1, equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instructions except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of at least 32-gauge [0.0134 inch (0.34 mm)] sheet metal. The cap nail shank shall be a minimum of 12 gauge [0.105 inch (2.67 mm)] with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19.1 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**1507.9.4 Ice barrier.** In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of

underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

**Exception:** Detached accessory structures that contain no conditioned floor area.

**1507.9.5 Interlayment.** Interlayment shall comply with ASTM D 226, Type I.

**1507.9.6 Material standards.** Wood shakes shall comply with the requirements of Table 1507.9.6.

**TABLE 1507.9.6  
WOOD SHAKE MATERIAL REQUIREMENTS**

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWP A U1 (Commodity Specification A, Use Category 3B and Section 5.6)	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.

TFS = Forest Products Laboratory of the Texas Forest Services.

**1507.9.7 Attachment.** Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 3/4 inch (19.1 mm) into the sheathing. For sheathing less than 1/2 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with a minimum of two fasteners.

**1507.9.8 Application.** Wood shakes shall be laid with a side lap not less than 1 1/2 inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 3/8 to 5/8 inches (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be 1/4 to 3/8 inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.8.

**TABLE 1507.9.8  
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10 <sup>a</sup>
Preservative-treated taper sawn shakes of Southern yellow pine	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5

For SI: 1 inch = 25.4 mm.

a. For 24-inch by 0.375-inch handsplit shakes, the maximum exposure is 7.5 inches.

**TABLE 1507.10.2  
BUILT-UP ROOFING MATERIAL STANDARDS**

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D 1227; D 2823; D 2824; D 4479
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal-tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar pitch used in roofing	ASTM D 450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D 43
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665, D 5726

**1507.9.9 Flashing.** At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet complying with ASTM D 1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

**1507.10 Built-up roofs.** The installation of built-up roofs shall comply with the provisions of this section.

**1507.10.1 Slope.** Built-up roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage, except for coal-tar built-up roofs that shall have a design slope of a minimum one-eighth unit vertical in 12 units horizontal (1-percent slope).

**1507.10.2 Material standards.** Built-up roof covering materials shall comply with the standards in Table 1507.10.2 or UL 55A.

**1507.11 Modified bitumen roofing.** The installation of modified bitumen roofing shall comply with the provisions of this section.

**1507.11.1 Slope.** Modified bitumen membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

**1507.11.2 Material standards.** Modified bitumen roof coverings shall comply with CGSB 37-GP-56M, ASTM D 6162, ASTM D 6163, ASTM D 6164, ASTM D 6222, ASTM D 6223, ASTM D 6298 or ASTM D 6509.

**1507.12 Thermoset single-ply roofing.** The installation of thermoset single-ply roofing shall comply with the provisions of this section.

**1507.12.1 Slope.** Thermoset single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

**1507.12.2 Material standards.** Thermoset single-ply roof coverings shall comply with ASTM D 4637, ASTM D 5019 or CGSB 37-GP-52M.

**1507.12.3 Ballasted thermoset low-slope roofs.** Ballasted thermoset low-slope roofs (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.4. Stone used as ballast shall comply with ASTM D 448.

**1507.13 Thermoplastic single-ply roofing.** The installation of thermoplastic single-ply roofing shall comply with the provisions of this section.

**1507.13.1 Slope.** Thermoplastic single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

**1507.13.2 Material standards.** Thermoplastic single-ply roof coverings shall comply with ASTM D 4434, ASTM D 6754, ASTM D 6878 or CGSB CAN/CGSB 37-54.

**1507.13.3 Ballasted thermoplastic low-slope roofs.** Ballasted thermoplastic low-slope roofs (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.4. Stone used as ballast shall comply with ASTM D448.

**1507.14 Sprayed polyurethane foam roofing.** The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

**1507.14.1 Slope.** Sprayed polyurethane foam roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

**1507.14.2 Material standards.** Spray-applied polyurethane foam insulation shall comply with Type III or IV as defined in ASTM C 1029.

**1507.14.3 Application.** Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Table 1507.14.3 shall be applied no less than 2 hours nor more than 72 hours following the application of the foam.

**TABLE 1507.14.3  
PROTECTIVE COATING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D 6083
Silicone coating	ASTM D 6694
Moisture-cured polyurethane coating	ASTM D 6947

**1507.14.4 Foam plastics.** Foam plastic materials and installation shall comply with Chapter 26.

**1507.15 Liquid-applied roofing.** The installation of liquid-applied roofing shall comply with the provisions of this section.

**1507.15.1 Slope.** Liquid-applied roofing shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

**1507.15.2 Material standards.** Liquid-applied roofing shall comply with ASTM C 836, ASTM C 957, ASTM D 1227 or ASTM D 3468, ASTM D 6083, ASTM D 6694 or ASTM D 6947.

**1507.16 Roof gardens and landscaped roofs.** Roof gardens and landscaped roofs shall comply with the requirements of this chapter and Sections 1607.12.3 and 1607.12.3.1 and the *California Fire Code*.

**1507.16.1 Structural fire resistance.** The structural frame and roof construction supporting the load imposed upon the roof by the roof gardens or landscaped roofs shall comply with the requirements of Table 601.

**1507.17 Photovoltaic modules/shingles.** The installation of photovoltaic modules/shingles shall comply with the provisions of this section.

**1507.17.1 Material standards.** Photovoltaic modules/shingles shall be listed and labeled in accordance with UL 1703.

**1507.17.2 Attachment.** Photovoltaic modules/shingles shall be attached in accordance with the manufacturer's installation instructions.

**1507.17.3 Wind resistance.** Photovoltaic modules/shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic modules/shingles shall comply with the classification requirements of Table 1507.2.7.1(2) for the appropriate maximum nominal design wind speed. Photovoltaic modules/shingle packaging shall bear a label to indicate com-

pliance with the procedures in ASTM D 3161 and the required classification from Table 1507.2.7.1(2).

## SECTION 1508 ROOF INSULATION

**1508.1 General.** The use of above-deck thermal insulation shall be permitted provided such insulation is covered with an approved roof covering and passes the tests of FM 4450 or UL 1256 when tested as an assembly.

### Exceptions:

1. Foam plastic roof insulation shall conform to the material and installation requirements of Chapter 26.
2. Where a concrete roof deck is used and the above-deck thermal insulation is covered with an approved roof covering.

**1508.1.1 Cellulosic fiberboard.** Cellulosic fiberboard roof insulation shall conform to the material and installation requirements of Chapter 23.

**1508.2 Material standards.** Above-deck thermal insulation board shall comply with the standards in Table 1508.2.

**TABLE 1508.2  
MATERIAL STANDARDS FOR ROOF INSULATION**

Cellular glass board	ASTM C 552
Composite boards	ASTM C 1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C 578
Extruded polystyrene board	ASTM C 578
Mineral fiber insulation board	ASTM C 726
Perlite board	ASTM C 728
Polyisocyanurate board	ASTM C 1289, Type I or Type II
Wood fiberboard	ASTM C 208

## SECTION 1509 ROOFTOP STRUCTURES

**1509.1 General.** The provisions of this section shall govern the construction of rooftop structures.

**1509.2 Penthouses.** Penthouses in compliance with Sections 1509.2.1 through 1509.2.5 shall be considered as a portion of the story directly below the roof deck on which such penthouses are located. All other penthouses shall be considered as an additional story of the building.

**1509.2.1 Height above roof deck.** Penthouses constructed on buildings of other than Type I construction shall not exceed 18 feet (5486 mm) in height above the roof deck as measured to the average height of the roof of the penthouse.

### Exceptions:

1. Where used to enclose tanks or elevators that travel to the roof level, penthouses shall be permitted to have a maximum height of 28 feet (8534 mm) above the roof deck.

2. Penthouses located on the roof of buildings of Type I construction shall not be limited in height.

**1509.2.2 Area limitation.** The aggregate area of penthouses and other enclosed rooftop structures shall not exceed one-third the area of the supporting roof deck. Such penthouses and other enclosed rooftop structures shall not be required to be included in determining the building area or number of stories as regulated by Section 503.1. The area of such penthouses shall not be included in determining the fire area specified in Section 901.7.

**1509.2.3 Use limitations.** Penthouses shall not be used for purposes other than the shelter of mechanical or electrical equipment, tanks, or vertical shaft openings in the roof assembly.

**1509.2.4 Weather protection.** Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical and electrical equipment and the building interior from the elements.

**1509.2.5 Type of construction.** Penthouses shall be constructed with walls, floors and roofs as required for the type of construction of the building on which such penthouses are built.

**Exceptions:**

1. On buildings of Type I construction, the exterior walls and roofs of penthouses with a fire separation distance greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour fire-resistance rating. The exterior walls and roofs of penthouses with a fire separation distance of 20 feet (6096 mm) or greater shall not be required to have a fire-resistance rating.
  2. On buildings of Type I construction two stories or less in height above grade plane or of Type II construction, the exterior walls and roofs of penthouses with a fire separation distance greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour fire-resistance rating or a lesser fire-resistance rating as required by Table 602 and be constructed of fire-retardant-treated wood. The exterior walls and roofs of penthouses with a fire separation distance of 20 feet (6096 mm) or greater shall be permitted to be constructed of fire-retardant-treated wood and shall not be required to have a fire-resistance rating. Interior framing and walls shall be permitted to be constructed of fire-retardant-treated wood.
  3. On buildings of Type III, IV or V construction, the exterior walls of penthouses with a fire separation distance greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour fire-resistance rating or a lesser fire-resistance rating as required by Table 602. On buildings of Type III, IV or VA construction, the exterior walls of penthouses with a fire separation distance of 20 feet (6096 mm) or greater shall be permitted to be of Type IV or noncombustible construction or fire-retardant-treated wood and shall not be required to have a fire-resistance rating.
- 1509.3 Tanks.** Tanks having a capacity of more than 500 gallons (2 m<sup>3</sup>) located on the roof deck of a building shall be supported on masonry, reinforced concrete, steel or Type IV construction provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.
- 1509.3.1 Valve and drain.** In the bottom or on the side near the bottom of the tank, a pipe or outlet, fitted with a suitable quick-opening valve for discharging the contents into a drain in an emergency shall be provided.
- 1509.3.2 Location.** Tanks shall not be placed over or near a stairway or an elevator shaft, unless there is a solid roof or floor underneath the tank.
- 1509.3.3 Tank cover.** Unenclosed roof tanks shall have covers sloping toward the perimeter of the tanks.
- 1509.4 Cooling towers.** Cooling towers located on the roof deck of a building and greater than 250 square feet (23.2 m<sup>2</sup>) in base area or greater than 15 feet (4572 mm) in height above the roof deck, as measured to the highest point on the cooling tower, where the roof is greater than 50 feet (15 240 mm) in height above grade plane shall be constructed of noncombustible materials. The base area of cooling towers shall not exceed one-third the area of the supporting roof deck.
- Exception:** Drip boards and the enclosing construction shall be permitted to be of wood not less than 1 inch (25 mm) nominal thickness, provided the wood is covered on the exterior of the tower with noncombustible material.
- 1509.5 Towers, spires, domes and cupolas.** Towers, spires, domes and cupolas shall be of a type of construction having fire-resistance ratings not less than required for the building on top of which such tower, spire, dome or cupola is built. Towers, spires, domes and cupolas greater than 85 feet (25 908 mm) in height above grade plane as measured to the highest point on such structures, and either greater than 200 square feet (18.6 m<sup>2</sup>) in horizontal area or used for any purpose other than a belfry or an architectural embellishment, shall be constructed of and supported on Type I or II construction.
- 1509.5.1 Noncombustible construction required.** Towers, spires, domes and cupolas greater than 60 feet (18 288 mm) in height above the highest point at which such structure contacts the roof as measured to the highest point on such structure, or that exceeds 200 square feet (18.6 m<sup>2</sup>) in area at any horizontal section, or which is intended to be used for any purpose other than a belfry or architectural embellishment, or is located on the top of a building greater than 50 feet (1524 mm) in building height shall be constructed of and supported by noncombustible materials and shall be separated from the building below by construction having a fire-resistance rating of not less than 1.5 hours with openings protected in accordance with Section 712. Such structures located on the top of a building

greater than 50 feet (15 240 mm) in building height shall be supported by noncombustible construction.

**1509.5.2 Towers and spires.** Enclosed towers and spires shall have exterior walls constructed as required for the building on top of which such towers and spires are built. The roof covering of spires shall not be less than the same class of roof covering required for the building on top of which the spire is located.

**1509.6 Mechanical equipment screens.** Mechanical equipment screens shall be constructed of the materials specified for the exterior walls in accordance with the type of construction of the building. Where the fire separation distance is greater than 5 feet (1524 mm), mechanical equipment screens shall not be required to comply with the fire-resistance rating requirements.

**1509.6.1 Height limitations.** Mechanical equipment screens shall not exceed 18 feet (5486 mm) in height above the roof deck, as measured to the highest point on the mechanical equipment screen.

**Exception:** Where located on buildings of Type IA construction, the height of mechanical equipment screens shall not be limited.

**1509.6.2 Types I, II, III and IV construction.** Regardless of the requirements in Section 1509.6, mechanical equipment screens shall be permitted to be constructed of combustible materials where located on the roof decks of building of Type I, II, III or IV construction in accordance with any one of the following limitations:

1. The fire separation distance shall not be less than 20 feet (6096 mm) and the height of the mechanical equipment screen above the roof deck shall not exceed 4 feet (1219 mm) as measured to the highest point on the mechanical equipment screen.
2. The fire separation distance shall not be less than 20 feet (6096 mm) and the mechanical equipment screen shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation.
3. Where exterior wall covering panels are used, the panels shall have a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E 84 or UL 723. The panels shall be tested in the minimum and maximum thicknesses intended for use in accordance with, and shall comply with the acceptance criteria of, NFPA 285 and shall be installed as tested. Where the panels are tested as part of an exterior wall assembly in accordance with NFPA 285, the panels shall be installed on the face of the mechanical equipment screen supporting structure in the same manner as they were installed on the tested exterior wall assembly.

**1509.6.3 Type V construction.** The height of mechanical equipment screens located on the roof decks of buildings of Type V construction, as measured from grade plane to the highest point on the mechanical equipment screen,

shall be permitted to exceed the maximum building height allowed for the building by other provisions of this code where complying with any one of the following limitations, provided the fire separation distance is greater than 5 feet (1524 mm):

1. Where the fire separation distance is not less than 20 feet (6096 mm), the height above grade plane of the mechanical equipment screen shall not exceed 4 feet (1219 mm) more than the maximum building height allowed;
2. The mechanical equipment screen shall be constructed of noncombustible materials;
3. The mechanical equipment screen shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation; or
4. Where the fire separation distance is not less than 20 feet (6096 mm), the mechanical equipment screen shall be constructed of materials having a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E 84 or UL 723.

**1509.7 Photovoltaic systems.** Rooftop mounted photovoltaic systems shall be designed in accordance with this section.

**1509.7.1 Wind resistance.** Rooftop mounted photovoltaic systems shall be designed for wind loads for component and cladding in accordance with Chapter 16 using an effective wind area based on the dimensions of a single unit frame.

**Exception:** [BSC, HCD-1, HCD-2, DSA-SS, DSA-SS/CC] The effective wind area shall be in accordance with Chapter 16 and ASCE 7 Section 26.2.

**1509.7.2 Fire classification.** Rooftop mounted photovoltaic systems shall have the fire classification as required by Section 1505.9.

**1509.7.3 Installation.** Rooftop mounted photovoltaic systems shall be installed in accordance with the manufacturer's installation instructions.

**1509.7.4 Photovoltaic panels and modules.** Photovoltaic panels and modules mounted on top of a roof shall be listed and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's installation instructions.

**1509.8 Other rooftop structures.** Rooftop structures not regulated by Sections 1509.2 through 1509.7 shall comply with Sections 1509.8.1 through 1509.8.5 as applicable.

**1509.8.1 Aerial supports.** Aerial supports shall be constructed of noncombustible materials.

**Exception:** Aerial supports not greater than 12 feet (3658 mm) in height as measured from the roof deck to the highest point on the aerial supports shall be permitted to be constructed of combustible materials.

**1509.8.2 Bulkheads.** Bulkheads used for the shelter of mechanical or electrical equipment or vertical shaft openings in the roof assembly shall comply with Section

1509.2 as penthouses. Bulkheads used for any other purpose shall be considered as an additional story of the building.

**1509.8.3 Dormers.** Dormers shall be of the same type of construction as required for the roof in which such dormers are located or the exterior walls of the building.

**1509.8.4 Fences.** Fences and similar structures shall comply with Section 1509.6 as mechanical equipment screens.

**1509.8.5 Flagpoles.** Flagpoles and similar structures shall not be required to be constructed of noncombustible materials and shall not be limited in height or number.

## SECTION 1510 REROOFING

**1510.1 General.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

**Exception:** Reroofing shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.

**1510.2 Structural and construction loads.** Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

**1510.3 Recovering versus replacement.** New roof coverings shall not be installed without first removing all existing layers of roof coverings down to the roof deck where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

### Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
2. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1510.4.
3. The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

4. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

**1510.4 Roof recovering.** Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

**1510.5 Reinstallation of materials.** Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

**1510.6 Flashings.** Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

## SECTION 1511 SOLAR PHOTOVOLTAIC PANELS/MODULES

**1511.1 Solar photovoltaic panels/modules.** Solar photovoltaic *panels/modules* installed upon a roof or as an integral part of a roof assembly shall comply with the requirements of this code (*see Section 3411*) and the *California Fire Code*.

**1511.1.1 Structural fire resistance.** The structural frame and roof construction supporting the load imposed upon the roof by the photovoltaic *panels/modules* shall comply with the requirements of Table 601 and *Section 602.1*.

## SECTION 1512 [DSA-SS & DSA-SS/CC, OSHPD 1, 2 & 4] SEISMIC ANCHORAGE OF SLATE SHINGLE, CLAY AND CONCRETE TILE ROOF COVERINGS

**1512.1 Fasteners.** Nails shall be long enough to penetrate into the sheathing  $\frac{3}{4}$  inch (19 mm). Where sheathing is less than  $\frac{3}{4}$  inch (19 mm) in thickness, nails shall be driven into supports, unless nails with ring shanks are used.

*All fasteners shall be corrosion resistant and fabricated of copper, stainless steel, or brass, or shall have a hot dipped galvanized coating not less than 1.0 ounce of zinc per square foot (305 gm/m<sup>2</sup>).*

*Nails for slate shingles and clay or concrete tile shall be copper, brass or stainless steel with gage and length per common ferrous nails.*

**1512.2 Wire.** Wire for attaching slate shingles and clay or concrete tile shall be copper, brass or stainless steel capable of supporting four times the weight of tile.

*Wire supporting a single tile or shingle shall not be smaller than  $\frac{1}{16}$  inch (1.6 mm) in diameter. Continuous wire*



ties supporting more than one tile shall not be smaller than 0.084 inch (2 mm) in diameter.

**1512.3 Metal strips.** Metal strips for attaching slate shingles and clay or concrete tile shall be copper, brass or stainless steel capable of supporting four times the weight of tile.

**1512.4 Clay or concrete tiles.** Clay or concrete tile shall be installed in accordance with Table 1507.3.7 and as described herein.

1. On wood roofs or roofs of other material to which wood strips are secured, every cover or top tile when fastened with nails shall be nailed directly into 1<sup>1</sup>/<sub>4</sub> inches (32 mm) sound grain soft wood strips of sufficient height to support the tile.

Pan or bottom tiles shall be nailed directly to the roof sheathing or to wood strips. Wood strips shall be secured to the roof by nails spaced not over 12 inches (305 mm) apart.

2. On concrete roofs, wires shall be secured in place by wire loops embedded into the concrete not less than 2 inches (51 mm). The wire loops shall be spaced not more than 36 inches (914 mm) on center parallel to the eaves, and spaced vertically to allow for the minimum 3 inches (76 mm) lapping of the tile.
3. Where continuous ties of twisted wire, interlocking wires or metal strips extending from the ridge to eave are used to attach tile, the ties shall be attached to the roof construction at the ridge, eave and at intervals not exceeding 10 feet 0 inch (3048 mm) on center. The ties within 2 feet (610 mm) of the rake shall be attached at intervals of 5 feet (1524 mm).

Attachment for continuous ties shall be nails, screws staples or approved clips of the same material as the ties, and shall not be subjected to withdrawal forces. Attachments for continuous ties shall have an allowable working stress shear resistance of not less than twice the dead weight of the tile tributary to the attachment, but not less than 300 pounds (136 kg).

4. Tile with projecting anchor lugs at the bottom of the tiles shall be held in position by means of 1- inch by 2- inch (25mm by 51mm) wood stripping nailed to the roof sheathing over the underlay.
5. Clay or concrete tile on roofs with slopes exceeding 24 units vertical in 12 units horizontal (200 percent slope) shall be attached as required for veneer in Chapter 14. The nose of all tiles shall be securely fastened.
6. Clay or concrete tile shall have a minimum of two fasteners per tile. Tiles that are 8 inches (203 mm) in width or less are permitted to be fastened at the center of the head with one fastener per tile.
7. Interlocking clay or concrete tile shall have a minimum of one nail near center of head or two wire ties per tile.

**1512.5 Slate shingles.** Slate shingles on roofs with slopes exceeding 24 units vertical in 12 units horizontal (200 percent slope) shall be attached as required for veneer per Chapter 14.



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# HISTORY NOTE APPENDIX

## California Building Code Title 24, Part 2, California Code of Regulations (CCR)

For prior code history, see the History Note Appendix to the *California Building Code (CRC)*, 2010 Triennial Edition effective January 1, 2011.

1. BSC 03/12, SFM 02/12, OSHPD 03/12 & 04/12, DSA-SS 02/12, HCD 06/12, HCD 08/12, DSA-AC 01/12, BSCC 01/12, CDPH 01/12, SLC 01/12 — Adoption of the 2012 edition of the *International Building Code* published by the International Code Council, for incorporation into the *2013 California Building Code*, CCR Title 24, Part 2 with amendments for State regulated occupancies effective on January 1, 2014.



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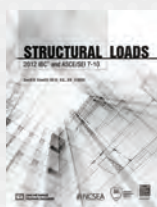
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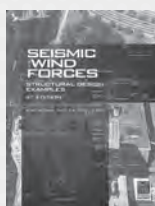


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## California Code of Regulations Title 24, Part 2, Volume 2 of 2

Based on the 2012 International Building Code®

2013 California Historical Building Code, Title 24, Part 8

2013 California Existing Building Code, Title 24, Part 10

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## California Building Standards Commission



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## PREFACE

This document is Part 2 of 12 parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the state's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

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California Building Standards Commission  
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This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

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For questions on California state agency amendments, please refer to the contact list on the following page.

# CALIFORNIA CODE OF REGULATIONS, TITLE 24

## California Agency Information Contact List

### Board of State and Community Corrections

www.bscc.ca.gov . . . . . (916) 445-5073  
Local Adult Jail Standards  
Local Juvenile Facility Standards

### California Building Standards Commission

www.bsc.ca.gov . . . . . (916) 263-0916

### California Energy Commission

www.enregy.ca.gov . . . . . **Energy Hotline** (800) 772-3300  
Building Efficiency Standards  
Appliance Efficiency Standards  
Compliance Manual/Forms

### California State Lands Commission

www.slc.ca.gov . . . . . (562) 499-6312  
Marine Oil Terminals

### California State Library

www.library.ca.gov . . . . . (916) 654-0266

### Department of Consumer Affairs:

#### Acupuncture Board

www.acupuncture.ca.gov . . . . . (916) 515-5200  
Office Standards

#### Board of Pharmacy

www.pharmacy.ca.gov . . . . . (916) 574-7900  
Pharmacy Standards

#### Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov . . . . . (916) 952-5210  
Barber and Beauty Shop,  
and College Standards

#### Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation

www.bearhfti.ca.gov . . . . . (916) 999-2041  
Insulation Testing Standards

#### Structural Pest Control Board

www.pestboard.ca.gov . . . . . (800) 737-8188  
Structural Standards

#### Veterinary Medical Board

www.vmb.ca.gov . . . . . (916) 263-2610  
Veterinary Hospital Standards

### Department of Food and Agriculture

www.cdffa.ca.gov  
Meat & Poultry Packing Plant Standards (916) 654-0509  
Dairy Standards (916) 654-0773

### Department of Housing and Community Development

www.hcd.ca.gov . . . . . (916) 445-9471

Residential- Hotels, Motels, Apartments,  
Single-Family Dwellings; and  
Permanent Structures in Mobilehome &  
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &  
Commercial Modular

Mobilehome- Permits & Inspections  
Northern Region-(916) 255-2501  
Southern Region-(951) 782-4420

(916) 445-9471

Employee Housing Standards

### Department of Public Health

www.dph.ca.gov . . . . . (916) 449-5661

Organized Camps Standards  
Public Swimming Pools Standards

### Division of the State Architect

www.dgs.ca.gov/dsa. . . . . (916) 445-8100

#### Access Compliance

#### Structural Safety

Public Schools Standards  
Essential Services Building Standards  
Community College Standards

### State Historical Building Safety Board

Alternative Building Standards

### Office of Statewide Health Planning and Development

www.oshpd.ca.gov . . . . . (916) 440-8356

Hospital Standards  
Skilled Nursing Facility Standards &  
Clinic Standards  
Permits

### Office of the State Fire Marshal

osfm.fire.ca.gov . . . . . (916) 445-8200

Code Development and Analysis  
Fire Safety Standards

## Marginal Markings

Solid vertical lines in the margins within the body of the code indicate a technical change from the requirements of the 2009 edition. Deletion indicators in the form of an arrow (➡) are provided in the margin where an entire section, paragraph, exception or table has been deleted or an item in a list of items or a table has been deleted.

A single asterisk [\*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk \*\*[\*\*] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2012 edition of the *International Building Code*.

2012 LOCATION	2009 LOCATION
407.4	1014.2
410.6	1015.6
424	402.6.3
712.1	708.1
712.1.2	708.2, Exception 1
712.1.3	708.2, Exception 2
712.1.3.1	708.2, Exception 2.1
712.1.3.2	708.2, Exception 2.2
712.1.4	708.2, Exception 3
712.1.5	708.2, Exception 4
712.1.6	708.2, Exception 5
712.1.7	708.2, Exception 6
712.1.8	708.2, Exception 7
712.1.9	708.2, Exception 8
712.1.10	708.2, Exception 9
712.1.11	708.2, Exception 10
712.1.12	708.2, Exception 11
712.1.13	708.2, Exception 12
712.1.14	708.2, Exception 13
712.1.15	708.2, Exception 14
712.1.16	708.2, Exception 15
712.1.18	708.2, Exception 16
713.3 through 713.14.1.1	708.3 through 708.14.1.1
909.21 through 909.21.11	708.14.2 through 708.14.2.11
1004.1.1.2	1004.6
1008.1.9.8	1008.1.4.4
1013.8	1405.13.2
1028.10.1	1017.4
1028.10.1.1	1017.4.1
1028.10.1.1	1017.4.2
1028.10.1.2	1017.4.3
1210.3.1	2903.1
1210.3.2	2903.2
1406.2.1	1406.2.1.1
1406.2.2	1406.2.1
1607.6	1605.4
1704.3	1705.1
<i>continued</i>	

<b>2012 LOCATION</b>	<b>2009 LOCATION</b>
1704.4	1709.1
1704.5	1710.1
1705.1.1	1704.15
1705.4.2	1704.11
1705.10	1706.1
1705.11	1707.1
1705.12	1708.1
3313.1	3311.4

# EFFECTIVE USE OF THE IBC/CBC

Distilling the code review process down to a methodical, sequential list of considerations is generally problematic. In many cases, related provisions from various chapters of the code must be considered simultaneously, or reconsidered later in the process to arrive at the correct classification or determination. Any number of acceptable alternatives may exist for construction of the building and its specific features. Each choice provided by the code must be evaluated for its specific impact on other aspects of the building's analysis. With a basic understanding of the interrelationship of the various chapters, the practiced code user will make an initial assessment of the building as a first step of the code review process. The following outline may be helpful as a guide for the effective use of the IBC, with the understanding that final resolution of each step is often dependant on subsequent steps.

The following process begins with a brief discussion of the key administrative areas of the code. The process addressing technical provisions is divided into two distinct areas of analysis, the nonstructural provisions of the IBC and the structural provisions. Although reference is not made to all provisions set forth in the IBC, the process is intended to be representative of an approach to using the IBC in an effective manner.

## Administrative Provisions

Prior to any analysis based on the technical provisions of the IBC, it is important that the fundamental administrative aspects of the code be reviewed. It is critical that the basis of technical decisions be consistent with the approach established in IBC Chapter 1, including:

- Scope of the IBC
- Intent of the IBC
- Applicability of the IBC
- Duties and powers of the building official
- Alternate materials, designs and methods of construction

## Nonstructural Provisions

**1. Classify the building for occupancy and construction type.** The first step in analyzing a building for code compliance is its proper classification based on anticipated use(s) and construction features.

**Identify the distinct and varied uses of the building.** The uses that will occur within the building must be identified, evaluated and classified into one or more of the distinct occupancy classifications established in the IBC. Some buildings will be classified as single-occupancy, where there is only one applicable occupancy classification. Others will be considered as mixed-occupancy due to the presence of two or more uses that are classified into different occupancy groups.

**Sec. 302.1 Classify the building into one or more occupancy groups.** Although there are 10 general occupancy groups, many of the groups are subdivided into sub-groups to allow for a more exacting analysis of the building under consideration.

Sec. 303	Group A
Sec. 304	Group B
Sec. 305	Group E
Sec. 306	Group F
Sec. 307	Group H
Sec. 308	Group I
Sec. 309	Group M
Sec. 310	Group R
Sec. 311	Group S
Sec. 312	Group U

**Identify the building's type of construction based on the materials of construction and degree of fire-resistance for the building's major elements.** The primary structural frame, exterior walls, interior walls, floor construction and roof construction, as applicable, must be evaluated in regard to their degree of fire-resistance and materials of construction in order to classify the building based upon type of construction.

**Sec. 602.1 Classify the building into a single type of construction.** Five general types of construction have been established and further subdivided into nine specific construction types. The classification of construction type is based on a combination of the degree of fire-resistance and the type of materials of the key building elements.

Sec. 602	Type of construction based on materials of construction
Table 601	Type of construction based on fire rating of the building elements
Sec. 603	Combustible materials in Type I and II buildings

**Sec. 1505 Verify classification of roof covering.** Roof coverings are typically required to provide protection against moderate or light fire exposures from the exterior. Their minimum required classification is based upon the type of construction of the building.

**2. Determine if the building is to be fully sprinklered.** Many of the code provisions vary based upon the presence of an automatic sprinkler system throughout, or in specific portions of, the building.

**Sec. 903.2 Determine if the building requires a fire sprinkler system.** Many of the mandates for the installation of a sprinkler system are based upon the occupancy or occupancies that occur within the building. The provisions will often require some degree of occupant load and fire area determination. Other conditions may also trigger a required sprinkler installation, such as building height or the lack of exterior openings.

**If a sprinkler system is not required, review for potential code modifications if a sprinkler system is installed.** There are a significant number of benefits provided by the code if a sprinkler system is installed. An initial analysis of the building will typically allow for an early determination of the value of such sprinkler benefits, including:

Sec. 504.2	Story and height increase (reduced type of construction)
Sec. 506.3	Allowable area increase (reduced type of construction)
Sec. 507.3	Unlimited area building (reduced type of construction)
Sec. 1018.1	Elimination of corridor fire-resistance rating

**3. Locate the building on the site.** The location of the building(s) on the lot is fundamental to the degree of fire exposure to and from adjoining buildings and lots. In addition, the building's location influences the amount of fire department access that can be provided from the exterior of the building.

**Sec. 503.1.2 Determine the number of buildings on the site.** Where two or more buildings are located on the same lot, they can be evaluated as a single building or multiple buildings. The type of construction requirements may differ based upon which of the two methods is utilized.

**Sec. 602.1 Determine minimum required fire rating of exterior walls.** The fire separation distance is the measurement used in evaluating the necessary fire rating for exterior walls. It is measured from the building to the lot line, to the center line of a public way, or to an imaginary assumed line between two buildings on the same lot. Projections and parapets, if applicable, are also regulated.

**Sec. 704.8 Determine exterior opening protection requirements.** Openings in exterior walls are regulated by the fire separation distance and the rating of the exterior wall in which they are located.

**Sec. 506.2 Determine frontage increase for allowable area purposes.** Utilized primarily for fire department access, open space adjacent to a building's perimeter provides for an increase in the allowable area.

**4. Verify building's construction type by determining the allowable building size.** The permitted types of construction are primarily based upon the occupancy classifications involved, the building's height and the building's floor area. Other conditions may also affect the appropriate construction types, including the building's location on the lot and the intended materials of construction. In buildings with mixed-occupancy conditions, the methods of addressing the relationship between the multiple occupancies indirectly affect construction type.

**Sec. 202 and 502 Calculate actual height of building in both 'feet' and 'stories above grade plane'.** The code specifically describes the method for assigning a building height, measure both in the number of feet and the number of stories above grade plane. The actual height must be compared with the allowable height to determine if the building's type of construction is acceptable.

**Sec. 504 Determine allowable height permitted for 'feet' and 'stories'**

**Sec. 505 Determine if mezzanine provisions are applicable**

**Sec. 504.3 Determine if any rooftop structures are in compliance**

**Sec. 502 Calculate actual floor area of each story of building.** The building area is typically the entire floor area that occurs within the surrounding exterior walls. The building area for each individual story must be calculated, as well as for the building as a whole.

**Sec. 507 Determine if building qualifies as an unlimited area building****Sec. 506 Determine allowable area permitted for each story and building as a whole if:**

- Sec. 506 Single-occupancy building
- Sec. 508.2 Multi-occupancy w/accessory occupancies
- Sec. 508.3 Multi-occupancy building w/nonseparated occupancies
- Sec. 508.4 Multi-occupancy building w/separated occupancies
- Sec. 706.1 Use of fire walls

**Sec. 509 Determine if special provisions are to be applied for height and/or area.** The general requirements for allowable height and area may be modified under limited conditions, typically where a parking garage is located in a building with other occupancies.

**5. Identify extent of any special detailed occupancy requirements.** Special types of buildings, special uses that occur within buildings, and special elements of a building are further regulated through specific requirements found in Chapter 4. Since these provisions are specific in nature, they apply in lieu of the general requirements found elsewhere in the code.

**Chapter 4. Determine special detailed requirements based on occupancy.** A number of the special provisions are applicable to a specific occupancy or group of similar occupancies.

- Sec. 402 Covered mall buildings
- Sec. 403 High-rise buildings
- Sec. 404 Atriums
- Sec. 405 Underground buildings
- Sec. 406 Motor-vehicle-related occupancies
- Sec. 407 Group I-2 occupancies
- Sec. 408 Group I-3 occupancies
- Sec. 411 Special amusement buildings
- Sec. 412 Aircraft-related occupancies
- Sec. 415 Group H occupancies
- Sec. 419 Live/work units
- Sec. 420 Groups I-1, R-1, R-2 and R-3
- Sec. 422 Ambulatory health care facilities

**Table 508.2.5 Determine if building contains any incidental accessory occupancies.** The uses identified in Table 508.5.2 are considered as a portion of the occupancy in which they are located, but special conditions required that they be addressed in a more specific manner.

- Sec. 508.2.5 Provide fire separation and/or fire-extinguishing system

**6. Identify and evaluate fire and smoke protective elements.** Where fire-resistance-rated construction and/or smoke protection is mandated by other provisions of the code, the provisions of Chapter 7 identify the appropriate methods for gaining compliance.

**Chapter 7. Verify compliance w/details of fire and smoke resistance.** The various elements of fire-resistance-rated and smoke-resistant construction are detailed, including walls, horizontal assemblies, shaft enclosures, including openings such as doors and windows, as well as the penetration of such elements by conduit, ducts, piping and other items.

- Sec. 704 Structural members
- Sec. 707 Fire barriers
- Sec. 709 Fire partitions
- Sec. 710 Smoke barriers
- Sec. 711 Smoke partitions
- Sec. 712 Horizontal assemblies
- Sec. 708 Shaft enclosures
- Sec. 713 Penetrations
- Sec. 714 Joint systems
- Sec. 715 Opening protectives
- Sec. 716 Ducts and air transfer openings



**7. Identify additional fire protection systems that may be required.** In addition to automatic sprinkler systems, there are several other types of fire protection systems that may be required in a building.

**Sec. 907.2. Determine compliance with fire alarm provisions.** Fire alarm systems are typically mandated based upon the occupancy classification and the number of occupants.

**Sec. 905.3. Determine if standpipe system is required.** A standpipe system is required in buildings once a specified height is reached to provide for a more effective means of fighting a fire within the building.

**Sec. 905.4.6. Verify location of standpipe hose connections.**

**8. Identify and evaluate materials utilized as interior floor, wall and ceiling finishes.** Finish materials within the building are primarily regulated for flame spread and smoke development characteristics.

**Sec. 803.9. Verify compliance of wall and ceiling finishes.** Interior wall and ceiling finishes are regulated based upon the occupancy classification of the space and their location within the means of egress system. The classification may typically be reduced where sprinkler protection is provided.

**Sec. 804.4. Verify compliance of floor finishes.** While regulated differently than wall and ceiling finishes, floor finishes comprised of fibers are also controlled based upon their use in the egress system, the occupancy classification, and the presence of a sprinkler system.

**9. Evaluate means of egress system based on anticipated occupant loads.** The expected occupant load is the basis for the design of the means of egress system. The egress elements must provide for a direct, continuous, obvious, undiminished and unobstructed path of travel from any occupiable point in the building to the public way.

**Sec. 1004. Determine the design occupant load.** Although the primary use of an occupant load is in the design of the building's means of egress system, occupant load is also occasionally an important factor in occupancy classification, sprinkler system and fire alarm system requirements, and plumbing fixture counts.

**Chapter 10. Verify compliance with means of egress provisions.** The means of egress system is intended to provide the primary occupant protection from fire and other hazards. The system consists of two major components, egress components and egress design.

- Sec. 1005.1 Egress width and distribution
- Sec. 1006.3 Emergency lighting
- Sec. 1007 Accessible means of egress
- Sec. 1008.1.2 Door swing
- Sec. 1008.1.9 Door operations
- Sec. 1008.1.10 Panic hardware
- Sec. 1009.1 Stairway width
- Sec. 1009.4 Stairway treads and risers
- Sec. 1011 Exit signs
- Sec. 1012 Stairway and ramp handrails
- Sec. 1013 Guards
- Sec. 1014.2 Egress through intervening spaces
- Sec. 1014.3 Common path of egress travel
- Sec. 1015.1 Number of exit or exit access doorways
- Sec. 1015.2 Egress separation
- Sec. 1016.1 Travel distance
- Sec. 1018.1 Corridor construction
- Sec. 1021 Number of exits
- Sec. 1022 Vertical exit enclosures
- Sec. 1023 Exit passageways
- Sec. 1025 Horizontal exits
- Sec. 1026 Exterior exit stairways
- Sec. 1027 Exit discharge
- Sec. 1028 Egress from assembly occupancies

**10. Identify any special use features of the building.** The activities that occur within the building pose varying risks to the occupants. Special conditions are applicable when such activities are anticipated.

**Chapter 4. Verify compliance with special detailed requirements.** These provisions are often an extension of the general requirements found elsewhere in the code.

Sec. 410	Stages and platforms
Sec. 413	Combustible storage
Sec. 414	Hazardous materials
Sec. 416	Application of flammable finishes

**11. Determine areas of building and site required to be accessible.** In general, access to persons with disabilities is required for all buildings.

**Chapter 11A and/or 11B. Verify compliance with accessibility provisions.** In order to be considered as accessible, buildings and their individual elements must comply with the applicable technical provisions of Chapters 11A and/or 11B.

**12. Determine extent of other miscellaneous provisions.** Additional provisions may be applicable based upon each individual building and its characteristics.

**Sec. 2406.3. Verify safety glazing provided in hazardous locations.** Safety glazing must be appropriately identified to ensure the proper glazing material is installed in areas considered as subject to human impact.

**Chapter 12. Interior environment.** Provisions regulating ventilation, temperature control, lighting, sound transmission, room dimensions and surrounding materials associated with interior spaces.

**Chapter 14 Exterior walls.** Requirements for installation of wall coverings and the permissible use of combustible materials on the exterior side of exterior walls.

**Chapter 24. Glass and glazing.** General provisions for the installation of glazing materials and skylights.

**Chapter 30. Elevators.** Elevator hoistway provisions, including enclosure of hoistways, emergency operations and hoistway venting.

**Chapter 31. Special construction.** A variety of special conditions are addressed, including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings and canopies, marquees, signs and swimming pool enclosures.

## Structural Provisions

### General Requirements

#### 1. Design Loads.

The 2012 IBC references the national load standard, Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7—10) with Supplement Number 2.

Determine the applicable design loads that the building structure is expected to be subjected to. Code prescribed loads are given in Chapter 16 and the referenced standard, ASCE/SEI 7. The code prescribed minimum live loads are given in IBC Table 1607.1.

The various code prescribed loads are probabilistic in nature. Environmental loads, such as flood, rain, snow, seismic and wind vary based on the location of the building site. The following table gives the IBC section and ASCE/SEI 7 chapter for various types of load.

REFERENCED IBC SECTIONS AND ASCE/SEI 7 CHAPTERS FOR LOADS		
TYPE OF LOAD	IBC SECTION	ASCE/SEI 7 CHAPTER
Dead loads	Section 1606	Chapter 3
Live loads	Section 1607, Table 1607.1	Chapter 4
Snow loads	Section 1608	Chapter 7
Wind loads	Section 1609	Chapter 6
Soil lateral loads	Section 1610	Chapter 3
Rain loads	Section 1611	Chapter 8
Flood loads	Section 1612	Chapter 51
Earthquake loads	Section 1613	Chapter 11-22

1. Section 1612 references ASCE 24 which references Chapter 5 of ASCE/SEI 7

## 2. Structural Materials.

The structural design begins with the selection of the type of structural materials to be used to support the building. Structural framing systems are constructed of concrete, masonry, steel or wood. Some miscellaneous or specialty structures and components, such as awnings, canopies and cladding, are often constructed of aluminum.

The design of various structural materials is covered in specific material chapters in the code which in turn reference design standards for the type of material involved. The referenced standards in the 2012 IBC for the structural materials are shown in the following table:

STRUCTURAL DESIGN STANDARDS FOR STRUCTURAL MATERIALS <sup>1</sup>		
MATERIAL	IBC/CBC CHAPTER	REFERENCED STANDARD
Concrete	19	ACI 318—11 Building Code Requirements for Structural Concrete
Aluminum	20	ADM 1—10 Aluminum Design Manual
Masonry	21	TMS 402-11/ACI 530-11/ASCE 5-11 Building Code Requirements and Specification for Masonry Structures (MSJC Code)
Steel	22	AISC 360—10 Specification for Structural Steel Buildings  AISC 341—10 Seismic Provisions for Structural Steel Buildings  AISI S100—07/S2-10 North American Specification for the Design of Cold-Formed Steel Structural Members, with Supplement 1, dated 2010.
Wood	23	AF&PA NDS—12 National Design Specification (NDS) for Wood Construction with 2012 Supplement  AF&PA SDPWS—08 Special Design Provisions for Wind and Seismic

1. The above table shows the main structural design standards for these structural materials. For a complete list of referenced standards, see IBC Chapter 35.

## 3. Structural Analysis, Design and Detailing.

Once the applicable loads are determined, the structural system of the building must be analyzed to determine the effects of the governing gravity and lateral loads that act on the structure. The structural system of a typical building consists of the roof and floor systems, walls, beams and columns, and the foundation. From the structural analysis, the next step is to design the structural members, elements and systems to provide the minimum level of resistance in accordance with the various load combinations prescribed in Section 1605.

Once the structural elements and systems are designed, the next step is to detail the load transfer connections to provide a complete load path from the point of origin to the resisting element. In general, the ultimate resisting element of buildings and structures is the foundation and supporting ground. The final step is to prepare a complete set of construction documents as required by Sections 107 and 1603. Construction documents are defined in Section 202 as “Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.” In general, construction documents consist of plans, specifications and calculations.

Section 1603.1 requires construction documents to show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. Design loads required by Sections 1603.1.1 through 1603.1.9 must be indicated on the construction documents. If complete construction documents consisting of plans, specifications and calculations are provided, the items listed in Sections 1603.1.1 through 1603.1.9 are generally included.

The exception permits construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 need only indicate the following:

- Floor and roof live loads
- Ground snow load,  $P_g$ .
- Basic (3-second gust) wind speed (mph) and wind exposure category.
- Seismic design category and site class.
- Flood design data where sited in flood hazard areas
- Design load-bearing values of soils.

## General Requirements

### 1. Occupancy Category (IBC/CBC Table 1604.5).

Determine the occupancy category of the building based on Table 1604.5.

Where a structure is occupied by two or more occupancies that are not the same occupancy category, the building must be classified in the highest occupancy category corresponding to the various occupancies.

Where structures have two or more portions that are structurally separated, each separate portion should be separately classified.

Where a separated portion of a structure provides required access or egress from another portion of the building with a higher occupancy category, both portions of the building must be assigned the higher occupancy category.

Where a separated portion of a structure shares life safety components with another portion of the building with a higher occupancy category, both portions of the building must be assigned the higher occupancy category.

### 2. Floor and roof live loads (IBC/CBC Table 1607.1).

Determine uniformly distributed and concentrated floor live load for the floor areas of the building in accordance with Section 1603.1.1 and Table 1607.1.

Floor live load reduction in accordance with Section 1607.9 should be indicated for each type of live load that is reduced.

Determine the roof live load for roof areas in accordance with Section 1607.11.

Roof live load reduction in accordance with Section 1607.11.2 should be indicated for roof live loads that are reduced.

### 3. Snow load (IBC/CBC Section 1608, ASCE/SEI 7 Section 7).

Determine the ground snow load,  $P_g$ , based on the location of the building site in accordance with Figure 1608.2 for the contiguous United States and Table 1608.2 for Alaska.

In areas where the ground snow load,  $P_g$ , exceeds 10 psf, the following information should be determined:

1. Flat-roof snow load,  $P_f$ .
2. Snow exposure factor,  $C_e$ .
3. Snow load importance factor,  $I$ .
4. Thermal factor,  $C_t$ .

### 4. Wind speed and wind exposure category.

Determine the following information related to wind loads in accordance with Section 1603.1.4:

1. Basic 3-second gust wind speed (mph).
2. Wind importance factor,  $I$ .
3. Wind exposure category (B, C, D). If more than one wind exposure is used, the wind exposure for each wind direction should be determined.
4. The applicable internal pressure coefficient.
5. The design wind pressure (psf) used for the design of exterior component and cladding materials not specifically designed by the registered design professional should be indicated.

## 5. Earthquake design requirements.

Determine the following information related to seismic loads regardless of whether seismic loads govern the design of the lateral-force-resisting system of the building:

1. Seismic importance factor,  $I$ , based on occupancy category.
2. Mapped spectral response accelerations,  $S_S$  and  $S_I$ .
3. Site class.
4. Design spectral response coefficients,  $S_{DS}$  and  $S_{DI}$ .
5. Seismic design category.
6. Basic seismic-force-resisting system(s).
7. Design base shear.
8. Seismic response coefficient(s),  $C_S$ .
9. Response modification factor(s),  $R$ .
10. Analysis procedure used.

## 6. Geotechnical information.

The design load bearing values of soils shall be shown on the construction documents in accordance with Section 1603.1.6.

## 7. Special loads.

Determine any special loads that are applicable to the design of the building, structure or portions thereof along with the specific section of the code that addresses the special loading condition in accordance with Section 1603.1.8.

## 8. Load combinations.

Buildings and other structures and portions thereof are required to be designed to resist the load combinations specified in Section 1605.2 or 1605.3 and Chapters 18 through 23, and the special seismic load combinations with overstrength as required by Section 1605.1 and ASCE/SEI 7.

## 9. Wind and seismic detailing.

Lateral-force-resisting systems are required to conform to the seismic detailing requirements of the code and ASCE/SEI 7 (excluding Chapter 14 and Appendix 11A) even when wind load effects are greater than seismic load effects. See Section 1604.10.

## 10. Serviceability.

Structural systems and members shall be designed to have adequate stiffness to limit deflections and lateral drift. The deflection of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.6 or that permitted by Table 1604.3. Structural systems shall be designed to have adequate stiffness to limit deformation and lateral drift due to earthquake loading in accordance with Section 12.12.1 of ASCE/SEI 7.

## 11. Foundation.

A foundation system must be designed that provides adequate support for gravity and lateral loads. Walls of buildings of conventional light frame construction, as defined in Section 202, are permitted to be supported by footings constructed in accordance with Table 1809.7. Otherwise, the foundation system must be designed in accordance with other provisions of Chapter 18. The following table gives a summary of applicable sections for foundation systems.

FOUNDATION REQUIREMENTS	
SUBJECT	IBC SECTION
Presumptive load-bearing values of soils	1806, Table 1806.2
Foundation walls, retaining walls and embedded posts & poles	1807
General requirements for foundations	1808
Minimum concrete specified concrete strength	Table 1808.8.1
Minimum concrete cover	Table 1808.8.2
Shallow foundations (footings)	1809
Prescriptive footings for light frame walls	Table 1809.7
Deep foundations	1810

A geotechnical investigation is required where required by Section 1803.2 unless the building official determines that a soils investigation is not required in accordance with the exception. A geotechnical investigation is required for buildings assigned to Seismic Design Categories C, D, E and F in accordance with Sections 1803.5.11 and 1803.5.12.

## 12. Excavation, grading and fill

Requirements for excavation, grading and fill related to foundation construction are covered in Section 1804. General requirements for site grading are covered in Appendix J.

## 13. Flood design data.

Where required by Section 1612.5, buildings located in flood hazard areas as established in Section 1612.3 are required to provide documentation that includes the following information regardless of whether flood loads govern the design of the building:

1. In flood hazard areas not subject to high-velocity wave action, the elevation of the proposed lowest floor, including the basement; and the elevation to which any nonresidential building will be dry flood proofed.
2. In flood hazard areas not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry floodproofed.
3. In flood hazard areas subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

## 14. Special inspection.

Where special inspection, special inspection for seismic resistance, or structural testing for seismic resistance is required by Section 1704, 1707 or 1708, the registered design professional in responsible charge is required to prepare a statement of special inspections in accordance with Section 1705. The statement of special inspections must be submitted by the permit applicant as a condition of permit issuance in accordance with Section 106.1.

A statement of special inspections is not required for structures designed and constructed in accordance with the conventional construction provisions of Section 2308 unless specific components in the structure require special inspection.

The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

SPECIAL INSPECTION REQUIREMENTS		
TYPE OF SPECIAL INSPECTION	APPLICABLE SECTION	REQUIRED VERIFICATION AND INSPECTION
Steel construction	1704.3	Table 1704.3
Concrete construction	1704.4	Table 1704.4
Masonry construction		
Level 1	1704.5	Table 1704.5.1
Level 2		Table 1704.5.3
Wood construction	1704.6	—
Soils	1704.7	Table 1704.7
Driven deep foundations	1704.8	Table 1704.8
Cast in place deep foundations	1704.9	Table 1704.9
Helical pile foundations	1704.10	—
Vertical masonry foundations	1704.11 1704.5	—
Sprayed fire resistant materials	1704.12	—
Mastic and intumescent fire resistive coatings	1704.13	—
Exterior insulation and finish (EIFS) systems	1704.14	—
Special cases	1704.15	—
Smoke control systems	1704.16	—

Where required by the provisions of Section 1709.2 or 1709.3, the owner shall employ a registered design professional to perform structural observations as defined in Section 1702. At the conclusion of the work included in the permit, the structural observer shall submit a written statement to the building official that identifies any reported deficiencies that have not been resolved.



**15. Special inspection for wind and seismic resistance.**

Section 1706.1 requires special inspections for wind requirements based on wind speed and exposure category as prescribed in Sections 1706.2 through 1706.4, unless exempted by the exceptions to Section 1704.1.

Section 1707.1 requires special inspections for seismic resistance based on seismic design category as prescribed in Sections 1707.2 through 1707.9, unless exempted by the exceptions of Section 1704.1 or 1705.3.

**16. Structural testing for seismic resistance.**

Section 1708.1 requires specific testing and qualification for seismic resistance as prescribed in Sections 1708.2 through 1708.5, unless exempted from special inspections by the exceptions of Section 1704.1 and 1705.3.

**17. Structural observation.**

Where required by the provisions of Section 1710.2 or 1710.3 the owner is required to employ a registered design professional to perform structural observations as defined in Section 1702. Section 1710.2 requires structural observations for seismic resistance for certain structures assigned to Seismic Design Category D, E or F; Section 1710.3 requires structural observations for wind requirements for certain structures sited where the wind speed exceeds 110 mph.

At the conclusion of the work included in the permit, the structural observer is required to submit a written statement to the building official that identifies any reported deficiencies that have not been resolved.

Prior to the commencement of observations, the structural observer is required to submit a written statement to the building official identifying the structural observations.

At the conclusion of the work included in the permit, the structural observer is required to submit a written statement to the building official indicating what site visits have been made, identifies any deficiencies that have not been resolved.

**18. Contractor responsibility.**

Section 1709 requires each contractor responsible for the construction of a main wind- or seismic-force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections is required to submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. (The term “designated seismic system” is defined in Section 1702 and Section 11.2 of ASCE/SEI 7). The contractor’s statement of responsibility is required to acknowledge awareness of the special requirements contained in the statement of special inspections.

**19. Phased approvals.**

Construction of foundations or other part of a building is permitted before the construction documents for the whole building or structure have been submitted, provided adequate information has been filed. The holder of such permit for the foundation or other part of a building proceeds at their own risk and without assurance that a permit for the entire structure will be granted.

**20. Amended construction documents.**

Work must be constructed in accordance with the approved construction documents and any changes made during construction that are not in compliance with the approved construction documents must be resubmitted for approval as amended construction documents.

**21. Deferred submittals.**

Deferred submittals are items that are not submitted at the time of permit application and must have the prior approval of the building official in accordance with Section 107.3.4.2. The registered design professional in responsible charge is required to list the deferred submittals on the construction documents for review by the building official. Documents for deferred submittal items must be reviewed by the registered design professional in responsible charge who will forward them to the building official with a notation indicating that they have been reviewed and are in general conformance with the design of the building.

# **How to Distinguish Between Model Code Language and California Amendments**

*To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italic font print.*

*[BSC] This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption, and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.*

## **Legend of Acronyms of Adopting State Agencies**

<i>BSC</i>	<i>California Building Standards Commission (see Section 1.2)</i>
<i>BSCC</i>	<i>Board of State and Community Corrections (see Section 1.3)</i>
<i>SFM</i>	<i>Office of the State Fire Marshal (see Section 1.11)</i>
<i>HCD 1</i>	<i>Department of Housing and Community Development (see Section 1.8.2.1.1)</i>
<i>HCD 2</i>	<i>Department of Housing and Community Development (see Section 1.8.2.1.3)</i>
<i>HCD 1/AC</i>	<i>Department of Housing and Community Development (see Section 1.8.2.1.2)</i>
<i>DSA-AC</i>	<i>Division of the State Architect-Access Compliance (see Section 1.9.1)</i>
<i>DSA-SS</i>	<i>Division of the State Architect-Structural Safety (see Section 1.9.2)</i>
<i>DSA-SS/CC</i>	<i>Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)</i>
<i>OSHPD 1</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.1)</i>
<i>OSHPD 2</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.2)</i>
<i>OSHPD 3</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.3)</i>
<i>OSHPD 4</i>	<i>Office of Statewide Health Planning and Development (see Section 1.10.4)</i>
<i>DPH</i>	<i>Department of Public Health (see Section 1.7)</i>
<i>AGR</i>	<i>Department of Food and Agriculture (see Section 1.6)</i>
<i>CEC</i>	<i>California Energy Commission (see Section 100 in Part 2, the California Energy Code)</i>
<i>CA</i>	<i>Department of Consumer Affairs (see Section 1.6): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Home Furnishings Structural Pest Control Board</i>
<i>SL</i>	<i>State Library (see Section 1.12)</i>
<i>SLC</i>	<i>State Lands Commission (see Section 1.14)</i>
<i>DWR</i>	<i>Department of Water Resources (see Section 1.12 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)</i>

*The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.*

*To learn more about the use of this code refer to pages xvii and xviii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission [www.bsc.ca.gov](http://www.bsc.ca.gov).*



Symbols in the margins indicate the status of code changes as follows:

|| This symbol indicates that a change has been made to a California amendment.

> This symbol indicates deletion of California amendment language.

| This symbol indicates that a change has been made to International Code Council model language.

➡ This symbol indicates deletion of International Code Council model language.

# California Matrix Adoption Tables

## Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency's statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies' adoption as follows:

## Adopt the entire IBC chapter without state amendments.

If there is an "X" under a particular state agency's acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

### Example:

**CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE**  
(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building application.)

### CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter		X																	
Adopt entire chapter as amended (amended sections listed below)						S	A	M	P	L	E								
Adopt only those sections that are listed below																			
Chapter/Section																			

## Adopt the entire IBC chapter as amended, state-amended sections are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an "X" in the column, by that particular section, under the agency's acronym, as well as an "X" by each section that the agency has adopted.

### Example:

### CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter																			
Adopt entire chapter as amended (amended sections listed below)		X																	
Adopt only those sections that are listed below						S	A	M	P	L	E								
Chapter/Section																			
202		X																	

## Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

### Example:

#### CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter																			
Adopt entire chapter as amended (amended sections listed below)																			
Adopt only those sections that are listed below				X	X		S	A	M	P	L	E							
Chapter 1																			
202				X	X		S	A	M	P	L	E							
202				X	X			C	O	N	T.								
203				X	X														
203				X	X														

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# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 16 – STRUCTURAL DESIGN

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter											X									
Adopt entire chapter as amended (amended sections listed below)	X		X	X				X		X										
Adopt only those sections that are listed below					X	X													X	
Chapter / Section																				
1601.1.1								X												
1601.1.2								X												
1601.1.3								X												
1601.1.4								X												
1601.2								X		X										
1601.3								X												
1602.1																				
1603.1										X										
1607.1, Table 1607.1										X										
1607.8			X	X	X															
1607.8.2			X	X	X	X														
1612.3										X										
1613.1										X										
1613.1.1																			X	
1613.1.2	X																			
1613.1.3	X																			
1613.3.1										X										
1613.3.2																				
1613.3.5										X										
1613.3.5.1										X										
1613.3.5.2										X										
1613.3.6.1																				
1613.3.6.2																				
1613.5	X		X	X						X										
1613.5.1	X		X	X						X										
1613.5.2	X		X	X						X										
1613.6	X																			
1616								X												



## CHAPTER 16

# STRUCTURAL DESIGN

### SECTION 1601 GENERAL

**1601.1 Scope.** The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

**1601.1.1 Application.** [DSA-SS/CC] The scope of application of Chapter 16 is as follows:

*Community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), as listed in Section 1.9.2.2.*

**1601.1.2 Identification of amendments.** [DSA-SS/CC] Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC) amendments appear in this chapter preceded with the appropriate acronym, as follows:

*Division of the State Architect - Structural Safety/Community Colleges: [DSA-SS/CC] - For community college buildings listed in Section 1.9.2.2*

**1601.1.3 Reference to other chapters.** [DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

**1601.1.4 Amendments.** [DSA-SS/CC] See Section 1616 for additional requirements.

**1601.2 Enforcement agency approval.** [DSA-SS/CC], OSHPD 2 In addition to requirements of the California Administrative Code and the California Building Code, any aspect of project design, construction, quality assurance or quality control programs for which this code requires approval by the design professional, are also subject to approval by the enforcement agency.

### SECTION 1602 DEFINITIONS AND NOTATIONS

**1602.1 Definitions.** The following terms are defined in Chapter 2:

**ALLOWABLE STRESS DESIGN.**

**DEAD LOADS.**

**DESIGN STRENGTH.**

**DIAPHRAGM.**

**Diaphragm, blocked.**

**Diaphragm boundary.**

**Diaphragm chord.**

**Diaphragm flexible.**

**Diaphragm, rigid.**

**DURATION OF LOAD.**

**ENFORCEMENT AGENT.** [OSHPD 2] That individual within the agency or organization charged with responsibility for agency or organization compliance with the requirements of this code. Used interchangeably with "Building Official" or "Code Official."

**ESSENTIAL FACILITIES.**

**FABRIC PARTITION.**

**FACTORED LOAD.**

**HELIPAD.**

**ICE-SENSITIVE STRUCTURE.**

**IMPACT LOAD.**

**LIMIT STATE.**

**LIVE LOAD.**

**LIVE LOAD (ROOF).**

**LOAD AND RESISTANCE FACTOR DESIGN (LRFD).**

**LOAD EFFECTS.**

**LOAD FACTOR.**

**LOADS.**

**NOMINAL LOADS.**

**OTHER STRUCTURES.**

**PANEL (PART OF A STRUCTURE).**

**RESISTANCE FACTOR.**

**RISK CATEGORY.**

**STRENGTH, NOMINAL.**

**STRENGTH, REQUIRED.**

**STRENGTH DESIGN.**

**SUSCEPTIBLE BAY.**

**VEHICLE BARRIER.**

**NOTATIONS.**

$D$  = Dead load.

$D_i$  = Weight of ice in accordance with Chapter 10 of ASCE 7.

$E$  = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4.2 of ASCE 7.

$F$  = Load due to fluids with well-defined pressures and maximum heights.

$F_a$  = Flood load in accordance with Chapter 5 of ASCE 7.

$H$  = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

$L$  = Roof live load greater than 20 psf (0.96 kN/m<sup>2</sup>) and floor live load.

$L_r$  = Roof live load of 20 psf (0.96 kN/m<sup>2</sup>) or less.

$R$  = Rain load.

- $S$  = Snow load.
- $T$  = Self-straining load.
- $V_{asd}$  = Nominal design wind speed (3-second gust), miles per hour (mph) (km/hr) where applicable.
- $V_{ult}$  = Ultimate design wind speeds (3-second gust), miles per hour (mph) (km/hr) determined from Figures 1609A, 1609B, or 1609C or ASCE 7.
- $W$  = Load due to wind pressure.
- $W_i$  = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

## SECTION 1603 CONSTRUCTION DOCUMENTS

**1603.1 General.** Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the construction documents.

**Exception:** Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof live loads.
2. Ground snow load,  $P_g$ .
3. Ultimate design wind speed,  $V_{ult}$ , (3-second gust), miles per hour (mph) (km/hr) and nominal design wind speed,  $V_{asd}$ , as determined in accordance with Section 1609.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612.3.
6. Design load-bearing values of soils.

**[OSHPD 2]** Additional requirements are included in Sections 7-115 and 7-125 of the California Administrative Code (Part 1, Title 24, C.C.R).

**1603.1.1 Floor live load.** The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.10 shall be indicated for each type of live load used in the design.

**1603.1.2 Roof live load.** The roof live load used in the design shall be indicated for roof areas (Section 1607.12).

**1603.1.3 Roof snow load data.** The ground snow load,  $P_g$ , shall be indicated. In areas where the ground snow load,  $P_g$ , exceeds 10 pounds per square foot (psf) (0.479 kN/m<sup>2</sup>), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load,  $P_f$ .
2. Snow exposure factor,  $C_e$ .
3. Snow load importance factor,  $I$ .
4. Thermal factor,  $C_r$ .

**1603.1.4 Wind design data.** The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

1. Ultimate design wind speed,  $V_{ult}$ , (3-second gust), miles per hour (km/hr) and nominal design wind speed,  $V_{asd}$ , as determined in accordance with Section 1609.3.1.
2. Risk category.
3. Wind exposure. Where more than one wind exposure is utilized, the wind exposure and applicable wind direction shall be indicated.
4. The applicable internal pressure coefficient.
5. Components and cladding. The design wind pressures in terms of psf (kN/m<sup>2</sup>) to be used for the design of exterior component and cladding materials not specifically designed by the registered design professional.

**1603.1.5 Earthquake design data.** The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. Risk category.
2. Seismic importance factor,  $I_e$ .
3. Mapped spectral response acceleration parameters,  $S_s$  and  $S_1$ .
4. Site class.
5. Design spectral response acceleration parameters,  $S_{DS}$  and  $S_{D1}$ .
6. Seismic design category.
7. Basic seismic force-resisting system(s).
8. Design base shear(s).
9. Seismic response coefficient(s),  $C_s$ .
10. Response modification coefficient(s),  $R$ .
11. Analysis procedure used.

**1603.1.6 Geotechnical information.** The design load-bearing values of soils shall be shown on the construction documents.

**1603.1.7 Flood design data.** For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.5, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. In flood hazard areas not subject to high-velocity wave action, the elevation of the proposed lowest floor, including the basement.
2. In flood hazard areas not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry flood proofed.

3. In flood hazard areas subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

**1603.1.8 Special loads.** Special loads that are applicable to the design of the building, structure or portions thereof shall be indicated along with the specified section of this code that addresses the special loading condition.

**1603.1.9 Systems and components requiring special inspections for seismic resistance.** Construction documents or specifications shall be prepared for those systems and components requiring special inspection for seismic resistance as specified in Section 1705.11 by the registered design professional responsible for their design and shall be submitted for approval in accordance with Section 107.1, *Chapter 1, Division II*. Reference to seismic standards in lieu of detailed drawings is acceptable.

## SECTION 1604 GENERAL DESIGN REQUIREMENTS

**1604.1 General.** Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters.

**1604.2 Strength.** Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

**1604.3 Serviceability.** Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift. See Section 12.12.1 of ASCE 7 for drift limits applicable to earthquake loading.

**1604.3.1 Deflections.** The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

**1604.3.2 Reinforced concrete.** The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

**1604.3.3 Steel.** The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 or SJI LH/DLH-1.1, as applicable.

**TABLE 1604.3  
DEFLECTION LIMITS<sup>a, b, c, h, i</sup>**

CONSTRUCTION	$L$	$S$ or $W^f$	$D + L^{d, g}$
Roof members: <sup>c</sup>			
Supporting plaster or stucco ceiling	$l/360$	$l/360$	$l/240$
Supporting nonplaster ceiling	$l/240$	$l/240$	$l/180$
Not supporting ceiling	$l/180$	$l/180$	$l/120$
Floor members	$l/360$	—	$l/240$
Exterior walls and interior partitions:			
With plaster or stucco finishes	—	$l/360$	—
With other brittle finishes	—	$l/240$	—
With flexible finishes	—	$l/120$	—
Farm buildings	—	—	$l/180$
Greenhouses	—	—	$l/120$

For SI: 1 foot = 304.8 mm.

- For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed  $l/60$ . For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed  $l/150$ . For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed  $l/90$ . For roofs, this exception only applies when the metal sheets have no roof covering.
- Interior partitions not exceeding 6 feet in height and flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.14.
- See Section 2403 for glass supports.
- For wood structural members having a moisture content of less than 16 percent at time of installation and used under dry conditions, the deflection resulting from  $L + 0.5D$  is permitted to be substituted for the deflection resulting from  $L + D$ .
- The above deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to assure adequate drainage shall be investigated for ponding. See Section 1611 for rain and ponding requirements and Section 1503.4 for roof drainage requirements.
- The wind load is permitted to be taken as 0.42 times the "component and cladding" loads for the purpose of determining deflection limits herein.
- For steel structural members, the dead load shall be taken as zero.
- For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers, not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed  $l/60$ . For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed  $l/175$  for each glass lite or  $l/60$  for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed  $l/120$ .
- For cantilever members,  $l$  shall be taken as twice the length of the cantilever.

**1604.3.4 Masonry.** The deflection of masonry structural members shall not exceed that permitted by TMS 402/ACI 530/ASCE 5.

**1604.3.5 Aluminum.** The deflection of aluminum structural members shall not exceed that permitted by AA ADM1.

**1604.3.6 Limits.** The deflection limits of Section 1604.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

**1604.4 Analysis.** Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the added eccentricities expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided their effect on the action of the system is considered and provided for in the design. Except where diaphragms are flexible, or are permitted to be analyzed as flexible, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter. See Section 1609 for wind loads, Section 1610 for lateral soil loads and Section 1613 for earthquake loads.

**1604.5 Risk category.** Each building and structure shall be assigned a risk category in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein.

**1604.5.1 Multiple occupancies.** Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another

portion having a higher risk category, both portions shall be assigned to the higher risk category.

**1604.6 In-situ load tests.** The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1709.

**1604.7 Preconstruction load tests.** Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707, shall be load tested in accordance with Section 1710.

**1604.8 Anchorage.** Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604.8.1 through 1604.8.3, as applicable.

**1604.8.1 General.** Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

**1604.8.2 Structural walls.** Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces specified in Section 1.4.4 of ASCE 7 for walls of structures assigned to Seismic Design Category A and to Section 12.11 of ASCE 7 for walls of structures assigned to all other seismic design categories. Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613 for earthquake design requirements.

**1604.8.3 Decks.** Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on all portions of the deck.
2. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

**TABLE 1604.5**  
**RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

<b>RISK CATEGORY</b>	<b>NATURE OF OCCUPANCY</b>
<b>I</b>	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> <li>• Agricultural facilities.</li> <li>• Certain temporary facilities.</li> <li>• Minor storage facilities.</li> </ul>
<b>II</b>	Buildings and other structures except those listed in Risk Categories I, III and IV
<b>III</b>	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> <li>• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.</li> <li>• Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than 250.</li> <li>• Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500.</li> <li>• Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities.</li> <li>• Group I-3 occupancies.</li> <li>• Any other occupancy with an occupant load greater than 5,000<sup>a</sup>.</li> <li>• Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV.</li> <li>• Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: <ul style="list-style-type: none"> <li>Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and</li> <li>Are sufficient to pose a threat to the public if released<sup>b</sup>.</li> </ul> </li> </ul>
<b>IV</b>	Buildings and other structures designated as essential facilities, including but not limited to: <ul style="list-style-type: none"> <li>• Group I-2 occupancies having surgery or emergency treatment facilities.</li> <li>• Fire, rescue, ambulance and police stations and emergency vehicle garages.</li> <li>• Designated earthquake, hurricane or other emergency shelters.</li> <li>• Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.</li> <li>• Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.</li> <li>• Buildings and other structures containing quantities of highly toxic materials that: <ul style="list-style-type: none"> <li>Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and</li> <li>Are sufficient to pose a threat to the public if released<sup>b</sup>.</li> </ul> </li> <li>• Aviation control towers, air traffic control centers and emergency aircraft hangars.</li> <li>• Buildings and other structures having critical national defense functions.</li> <li>• Water storage facilities and pump structures required to maintain water pressure for fire suppression.</li> </ul>

a. For purposes of occupant load calculation, occupancies required by Table 1004.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

**1604.9 Counteracting structural actions.** Structural members, systems, components and cladding shall be designed to resist forces due to earthquakes and wind, with consideration of overturning, sliding and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

**1604.10 Wind and seismic detailing.** Lateral force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7, excluding Chapter 14 and Appendix 11A, even when wind load effects are greater than seismic load effects.

## **SECTION 1605** **LOAD COMBINATIONS**

**1605.1 General.** Buildings and other structures and portions thereof shall be designed to resist:

1. The load combinations specified in Section 1605.2, 1605.3.1 or 1605.3.2;
2. The load combinations specified in Chapters 18 through 23; and
3. The seismic load effects including overstrength factor in accordance with Section 12.4.3 of ASCE 7 where required by Section 12.2.5.2, 12.3.3.3 or 12.10.2.1 of



ASCE 7. With the simplified procedure of ASCE 7 Section 12.14, the seismic load effects including overstrength factor in accordance with Section 12.14.3.2 of ASCE 7 shall be used.

Applicable loads shall be considered, including both earthquake and wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

Where the load combinations with overstrength factor in Section 12.4.3.2 of ASCE 7 apply, they shall be used as follows:

1. The basic combinations for strength design with overstrength factor in lieu of Equations 16-5 and 16-7 in Section 1605.2.
2. The basic combinations for allowable stress design with overstrength factor in lieu of Equations 16-12, 16-14 and 16-16 in Section 1605.3.1.
3. The basic combinations for allowable stress design with overstrength factor in lieu of Equations 16-21 and 16-22 in Section 1605.3.2.

**1605.1.1 Stability.** Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 1605.2 or 1605.3 shall be permitted. Where the load combinations specified in Section 1605.2 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807.2.3.

**1605.2 Load combinations using strength design or load and resistance factor design.** Where strength design or load and resistance factor design is used, buildings and other structures, and portions thereof, shall be designed to resist the most critical effects resulting from the following combinations of factored loads:

$$1.4(D + F) \quad (\text{Equation 16-1})$$

$$1.2(D + F) + 1.6(L + H) + 0.5(L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16-2})$$

$$1.2(D + F) + 1.6(L_r \text{ or } S \text{ or } R) + 1.6H + (f_1 L \text{ or } 0.5W) \quad (\text{Equation 16-3})$$

$$1.2(D + F) + 1.0W + f_1 L + 1.6H + 0.5(L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16-4})$$

$$1.2(D + F) + 1.0E + f_1 L + 1.6H + f_2 S \quad (\text{Equation 16-5})$$

$$0.9D + 1.0W + 1.6H \quad (\text{Equation 16-6})$$

$$0.9(D + F) + 1.0E + 1.6H \quad (\text{Equation 16-7})$$

where:

$f_1 = 1$  for places of public assembly live loads in excess of 100 pounds per square foot (4.79 kN/m<sup>2</sup>), and parking garages; and 0.5 for other live loads.

$f_2 = 0.7$  for roof configurations (such as saw tooth) that do not shed snow off the structure, and 0.2 for other roof configurations.

#### Exceptions:

1. Where other factored load combinations are specifically required by other provisions of this code, such combinations shall take precedence.
2. Where the effect of  $H$  resists the primary variable load effect, a load factor of 0.9 shall be included with  $H$  where  $H$  is permanent and  $H$  shall be set to zero for all other conditions.

**1605.2.1 Other loads.** Where flood loads,  $F_a$ , are to be considered in the design, the load combinations of Section 2.3.3 of ASCE 7 shall be used. Where self-straining loads,  $T$ , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.3.5 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.3.4 of ASCE 7 shall be considered.

#### 1605.3 Load combinations using allowable stress design.

**1605.3.1 Basic load combinations.** Where allowable stress design (working stress design), as permitted by this code, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

$$D + F \quad (\text{Equation 16-8})$$

$$D + H + F + L \quad (\text{Equation 16-9})$$

$$D + H + F + (L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16-10})$$

$$D + H + F + 0.75(L) + 0.75(L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16-11})$$

$$D + H + F + (0.6W \text{ or } 0.7E) \quad (\text{Equation 16-12})$$

$$D + H + F + 0.75(0.6W) + 0.75L + 0.75(L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16-13})$$

$$D + H + F + 0.75(0.7E) + 0.75L + 0.75S \quad (\text{Equation 16-14})$$

$$0.6D + 0.6W + H \quad (\text{Equation 16-15})$$

$$0.6(D + F) + 0.7E + H \quad (\text{Equation 16-16})$$

#### Exceptions:

1. Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 psf (1.44 kN/m<sup>2</sup>) or less and roof live loads of 30 psf (1.44 kN/m<sup>2</sup>) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m<sup>2</sup>), 20 percent shall be combined with seismic loads.

3. Where the effect of  $H$  resists the primary variable load effect, a load factor of 0.6 shall be included with  $H$  where  $H$  is permanent and  $H$  shall be set to zero for all other conditions.
4. In Equation 16-15, the wind load,  $W$ , is permitted to be reduced in accordance with Exception 2 of Section 2.4.1 of ASCE 7.
5. In Equation 16-16,  $0.6 D$  is permitted to be increased to  $0.9 D$  for the design of special reinforced masonry shear walls complying with Chapter 21.

**1605.3.1.1 Stress increases.** Increases in allowable stresses specified in the appropriate material chapter or the referenced standards shall not be used with the load combinations of Section 1605.3.1, except that increases shall be permitted in accordance with Chapter 23.

**1605.3.1.2 Other loads.** Where flood loads,  $F_a$ , are to be considered in design, the load combinations of Section 2.4.2 of ASCE 7 shall be used. Where self-straining loads,  $T$ , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.4.3 of ASCE 7 shall be considered.

**1605.3.2 Alternative basic load combinations.** In lieu of the basic load combinations specified in Section 1605.3.1, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. When using these alternative basic load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. When using allowable stresses which have been increased or load combinations which have been reduced as permitted by the material chapter of this code or the referenced standards, where wind loads are calculated in accordance with Chapters 26 through 31 of ASCE 7, the coefficient ( $\omega$ ) in the following equations shall be taken as 1.3. For other wind loads, ( $\omega$ ) shall be taken as 1. When allowable stresses have not been increased or load combinations have not been reduced as permitted by the material chapter of this code or the referenced standards, ( $\omega$ ) shall be taken as 1. When using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. When using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect,  $E_v$ , in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero.

$$D + L + (L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16-17})$$

$$D + L + 0.6 \omega W \quad (\text{Equation 16-18})$$

$$D + L + 0.6 \omega W + S/2 \quad (\text{Equation 16-19})$$

$$D + L + S + 0.6 \omega W/2 \quad (\text{Equation 16-20})$$

$$D + L + S + E/1.4 \quad (\text{Equation 16-21})$$

$$0.9D + E/1.4 \quad (\text{Equation 16-22})$$

#### Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 psf (1.44 kN/m<sup>2</sup>) or less and roof live loads of 30 psf (1.44 kN/m<sup>2</sup>) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m<sup>2</sup>), 20 percent shall be combined with seismic loads.

**1605.3.2.1 Other loads.** Where  $F$ ,  $H$  or  $T$  are to be considered in the design, each applicable load shall be added to the combinations specified in Section 1605.3.2. Where self-straining loads,  $T$ , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7.

\*

## SECTION 1606 DEAD LOADS

**1606.1 General.** Dead loads are those loads defined in Section 1602.1. Dead loads shall be considered permanent loads.

**1606.2 Design dead load.** For purposes of design, the actual weights of materials of construction and fixed service equipment shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

## SECTION 1607 LIVE LOADS

**1607.1 General.** Live loads are those loads defined in Section 1602.1.

**1607.2 Loads not specified.** For occupancies or uses not designated in Table 1607.1, the live load shall be determined in accordance with a method approved by the building official.

**1607.3 Uniform live loads.** The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed live loads given in Table 1607.1.

**1607.4 Concentrated live loads.** Floors and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated live loads, in pounds (kiloNewtons), given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of  $2\frac{1}{2}$  feet by  $2\frac{1}{2}$  feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

**TABLE 1607.1**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ , AND**  
**MINIMUM CONCENTRATED LIVE LOADS<sup>a</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
1. Apartments (see residential)	—	—
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150 <sup>m</sup>	—
4. Assembly areas		
Fixed seats (fastened to floor)	60 <sup>m</sup>	
Follow spot, projections and control rooms	50	
Lobbies	100 <sup>m</sup>	—
Movable seats	100 <sup>m</sup>	
Stage floors	150 <sup>m</sup>	
Platforms (assembly)	100 <sup>m</sup>	
Other assembly areas	100 <sup>m</sup>	
5. Balconies and decks <sup>b</sup>	Same as occupancy served	—
6. Catwalks	40	300
7. Cornices	60	—
8. Corridors		
First floor	100	
Other floors	Same as occupancy served except as indicated	—
9. Dining rooms and restaurants	100 <sup>m</sup>	—
10. Dwellings (see residential)	—	—
11. Elevator machine room grating (on area of 2 inches by 2 inches)	—	300
12. Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200
13. Fire escapes	100	
On single-family dwellings only	40	—
14. Garages (passenger vehicles only)	40 <sup>m</sup>	Note a
Trucks and buses	See Section 1607.7	
15. Handrails, guards and grab bars	See Section 1607.8	
16. Helipads	See Section 1607.6	
17. Hospitals		
Corridors above first floor	80	1,000
Operating rooms, laboratories	60	1,000
Patient rooms	40	1,000
18. Hotels (see residential)	—	—
19. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150 <sup>b, m</sup>	1,000
20. Manufacturing		
Heavy	250 <sup>m</sup>	3,000
Light	125 <sup>m</sup>	2,000
21. Marquees	75	—
22. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000

**TABLE 1607.1—continued**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ , AND**  
**MINIMUM CONCENTRATED LIVE LOADS<sup>a</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
23. Penal institutions		
Cell blocks	40	—
Corridors	100	—
24. Recreational uses:		
Bowling alleys, poolrooms and similar uses	75 <sup>m</sup>	
Dance halls and ballrooms	100 <sup>m</sup>	
Gymnasiums	100 <sup>m</sup>	—
Reviewing stands, grandstands and bleachers	100 <sup>c, m</sup>	
Stadiums and arenas with fixed seats (fastened to floor)	60 <sup>c, m</sup>	
25. Residential		
One- and two-family dwellings		
Uninhabitable attics without storage <sup>i</sup>	10	
Uninhabitable attics with storage <sup>j, k</sup>	20	
Habitable attics and sleeping areas <sup>k</sup>	30	
All other areas	40	—
Hotels and multifamily dwellings		
Private rooms and corridors serving them	40	
Public rooms <sup>m</sup> and corridors serving them	100	
26. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5 nonreducible	
All other construction	20	
Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	
Where primary roof members are exposed to a work floor, at single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs:		
Over manufacturing, storage warehouses, and repair garages		2,000
All other primary roof members		300
Occupiable roofs:		
Roof gardens	100	
Assembly areas	100 <sup>m</sup>	
All other similar areas	Note 1	Note 1
27. Schools		
Classrooms	40	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
28. Scuttles, skylight ribs and accessible ceilings	—	200
29. Sidewalks, vehicular drive ways and yards, subject to trucking	250 <sup>d, m</sup>	8,000 <sup>e</sup>
30. Stairs and exits		
One- and two-family dwellings	40	300 <sup>f</sup>
All other	100	300 <sup>f</sup>
31. Storage warehouses (shall be designed for heavier loads if required for anticipated storage)		
Heavy	250 <sup>m</sup>	—
Light	125 <sup>m</sup>	—

(continued)

**TABLE 1607.1—continued**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ , AND**  
**MINIMUM CONCENTRATED LIVE LOADS<sup>9</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
32. Stores		
Retail		
First floor	100	1,000
Upper floors	75	1,000
Wholesale, all floors	125 <sup>m</sup>	1,000
33. Vehicle barriers	See Section 1607.8.3	
34. Walkways and elevated platforms (other than exitways)	60	—
35. Yards and terraces, pedestrians	100 <sup>m</sup>	—
36. [OSHPD] Storage racks and wall-hung cabinets.	Total loads <sup>n</sup>	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>,  
 1 square foot = 0.0929 m<sup>2</sup>,  
 1 pound per square foot = 0.0479 kN/m<sup>2</sup>, 1 pound = 0.004448 kN,  
 1 pound per cubic foot = 16 kg/m<sup>3</sup>.

- a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches; (2) for mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds per wheel.
- b. The loading applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:
  1. The nominal bookstack unit height shall not exceed 90 inches;
  2. The nominal shelf depth shall not exceed 12 inches for each face; and
  3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches wide.
- c. Design in accordance with ICC 300.
- d. Other uniform loads in accordance with an approved method containing provisions for truck loadings shall also be considered where appropriate.
- e. The concentrated wheel load shall be applied on an area of 4.5 inches by 4.5 inches.
- f. The minimum concentrated load on stair treads shall be applied on an area of 2 inches by 2 inches. This load need not be assumed to act concurrently with the uniform load.
- g. Where snow loads occur that are in excess of the design conditions, the structure shall be designed to support the loads due to the increased loads caused by drift buildup or a greater snow design determined by the building official (see Section 1608).
- h. See Section 1604.8.3 for decks attached to exterior walls.
- i. Uninhabitable attics without storage are those where the maximum clear height between the joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- j. Uninhabitable attics with storage are those where the maximum clear height between the joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.  
 The live load need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:
  - i. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches; and
  - ii. The slopes of the joists or truss bottom chords are no greater than two units vertical in 12 units horizontal.
 The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 lb./ft<sup>2</sup>.
- k. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

**TABLE 1607.1—continued**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ , AND**  
**MINIMUM CONCENTRATED LIVE LOADS<sup>9</sup>**

- l. Areas of occupiable roofs, other than roof gardens and assembly areas, shall be designed for appropriate loads as approved by the building official. Unoccupied landscaped areas of roofs shall be designed in accordance with Section 1607.12.3.
- m. Live load reduction is not permitted unless specific exceptions of Section 1607.10 apply.
- n. [OSHPD] The minimum vertical design live load shall be as follows:  
*Paper media:*  
 12-inch-deep (305 mm) shelf 33 pounds per lineal foot (482 N/m)  
 15-inch-deep (381 mm) shelf 41 pounds per lineal foot (598 N/m), or  
 33 pounds per cubic foot (5183 N/m<sup>3</sup>) per total volume of the rack or cabinet, whichever is less.  
*Film media:*  
 18-inch-deep (457 mm) shelf 100 pounds per lineal foot (1459 N/m), or  
 50 pounds per cubic foot (7853 N/m<sup>3</sup>) per total volume of the rack or cabinet, whichever is less.  
*Other media:*  
 20 pounds per cubic foot (311 N/m<sup>3</sup>) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

**1607.5 Partition loads.** In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load exceeds 80 psf (3.83 kN/m<sup>2</sup>). The partition load shall not be less than a uniformly distributed live load of 15 psf (0.72 kN/m<sup>2</sup>).

**1607.6 Helipads.** Helipads shall be designed for the following live loads:

1. A uniform live load,  $L$ , as specified below. This load shall not be reduced.
  - 1.1. 40 psf (1.92 kN/m<sup>2</sup>) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.
  - 1.2. 60 psf (2.87 kN/m<sup>2</sup>) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).
2. A single concentrated live load,  $L$ , of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.
3. Two single concentrated live loads,  $L$ , 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000 pound (13.34 kN) weight limita-

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tion. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

**1607.7 Heavy vehicle loads.** Floors and other surfaces that are intended to support vehicle loads greater than a 10,000 pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.7.1 through 1607.7.5.

**1607.7.1 Loads.** Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

**1607.7.2 Fire truck and emergency vehicles.** Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official; or
2. The live loading specified in Section 1607.7.1.

**1607.7.3 Heavy vehicle garages.** Garages designed to accommodate vehicles that exceed a 10,000 pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607.7.1. For garages the design for impact and fatigue is not required.

**Exception:** The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided such loads and placement are based on rational engineering principles and are approved by the building official, but shall not be less than 50 psf (2.9 kN/m<sup>2</sup>). This live load shall not be reduced.

**1607.7.4 Forklifts and movable equipment.** Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted per Section 1607.7.5.

**1607.7.4.1 Impact and fatigue.** Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

**1607.7.5 Posting.** The maximum weight of the vehicles allowed into or on a garage or other structure shall be posted by the owner in accordance with Section 106.1.

**1607.8 Loads on handrails, guards, grab bars, shower seats, dressing room bench seats and vehicle barriers.**

Handrails, guards, grab bars, accessible seats, accessible benches and vehicle barriers shall be designed and constructed to the structural loading conditions set forth in this section.

**1607.8.1 Handrails and guards.** Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1 of ASCE 7. Glass handrail assemblies and guards shall also comply with Section 2407.

**Exceptions:**

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.8.1.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

**1607.8.1.1 Concentrated load.** Handrails and guards shall also be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

**1607.8.1.2 Intermediate rails.** Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1 of ASCE 7.

**1607.8.2 Grab bars, shower seats and dressing room bench seats.** Grab bars, shower seats and dressing room bench seat systems shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar or seat so as to produce the maximum load effects. (*DSA-AC & HCD 1-AC*) See Chapter 11A, Section 1127A.4, Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.

**1607.8.3 Vehicle barriers.** Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

**1607.9 Impact loads.** The live loads specified in Sections 1607.3 through 1607.8 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

**1607.9.1 Elevators.** Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1.

**1607.9.2 Machinery.** For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact: (1) light machinery, shaft- or motor-driven, 20 percent; and (2) reciprocating machinery or power-driven units, 50 percent. Percentages shall be increased where specified by the manufacturer.

**1607.10 Reduction in uniform live loads.** Except for uniform live loads at roofs, all other minimum uniformly distributed live loads,  $L_o$ , in Table 1607.1 are permitted to be reduced in accordance with Section 1607.10.1 or 1607.10.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607.12.2.

**1607.10.1 Basic uniform live load reduction.** Subject to the limitations of Sections 1607.10.1.1 through 1607.10.1.3 and Table 1607.1, members for which a value of  $K_{LL}A_T$  is 400 square feet (37.16 m<sup>2</sup>) or more are permitted to be designed for a reduced uniformly distributed live load,  $L$ , in accordance with the following equation:

$$L = L_o \left( 0.25 + \frac{15}{\sqrt{K_{LL}A_T}} \right) \quad (\text{Equation 16-23})$$

$$\text{For SI: } L = L_o \left( 0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}} \right)$$

where:

$L$  = Reduced design live load per square foot (m<sup>2</sup>) of area supported by the member.

$L_o$  = Unreduced design live load per square foot (m<sup>2</sup>) of area supported by the member (see Table 1607.1).

$K_{LL}$  = Live load element factor (see Table 1607.10.1).

$A_T$  = Tributary area, in square feet (m<sup>2</sup>).

$L$  shall not be less than  $0.50L_o$  for members supporting one floor and  $L$  shall not be less than  $0.40L_o$  for members supporting two or more floors.

**TABLE 1607.10.1  
LIVE LOAD ELEMENT FACTOR,  $K_{LL}$**

ELEMENT	$K_{LL}$
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
All other members not identified above including: Edge beams with cantilever slabs Cantilever beams One-way slabs Two-way slabs Members without provisions for continuous shear transfer normal to their span	1

**1607.10.1.1 One-way slabs.** The tributary area,  $A_T$ , for use in Equation 16-23 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

**1607.10.1.2 Heavy live loads.** Live loads that exceed 100 psf (4.79 kN/m<sup>2</sup>) shall not be reduced.

**Exceptions:**

1. The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall

not be less than  $L$  as calculated in Section 1607.10.1.

2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

**1607.10.1.3 Passenger vehicle garages.** The live loads shall not be reduced in passenger vehicle garages.

**Exception:** The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than  $L$  as calculated in Section 1607.10.1.

**1607.10.2 Alternative uniform live load reduction.** As an alternative to Section 1607.10.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m<sup>2</sup>) except that the design live load for members supporting two or more floors is permitted to be reduced by a maximum of 20 percent.

**Exception:** For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent.
3. For live loads not exceeding 100 psf (4.79 kN/m<sup>2</sup>), the design live load for any structural member supporting 150 square feet (13.94 m<sup>2</sup>) or more is permitted to be reduced in accordance with Equation 16-24.
4. For one-way slabs, the area,  $A$ , for use in Equation 16-24 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

$$R = 0.08(A - 150) \quad (\text{Equation 16-24})$$

$$\text{For SI: } R = 0.861(A - 13.94)$$

Such reduction shall not exceed the smallest of:

1. 40 percent for horizontal members;
2. 60 percent for vertical members; or
3.  $R$  as determined by the following equation.

$$R = 23.1(1 + D/L_o) \quad (\text{Equation 16-25})$$

where:

$A$  = Area of floor supported by the member, square feet (m<sup>2</sup>).

$D$  = Dead load per square foot ( $\text{m}^2$ ) of area supported.

$L_o$  = Unreduced live load per square foot ( $\text{m}^2$ ) of area supported.

$R$  = Reduction in percent.

**1607.11 Distribution of floor loads.** Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Floor live loads are permitted to be reduced in accordance with Section 1607.10.

**1607.12 Roof loads.** The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

**1607.12.1 Distribution of roof loads.** Where uniform roof live loads are reduced to less than 20 psf ( $0.96 \text{ kN/m}^2$ ) in accordance with Section 1607.12.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect. See Section 1607.12.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

**1607.12.2 General.** The minimum uniformly distributed live loads of roofs and marquees,  $L_o$ , in Table 1607.1 are permitted to be reduced in accordance with Section 1607.12.2.1.

**1607.12.2.1 Ordinary roofs, awnings and canopies.** Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load,  $L_r$ , as specified in the following equations or other controlling combinations of loads as specified in Section 1605, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf ( $0.58 \text{ kN/m}^2$ ).

$$L_r = L_o R_1 R_2 \quad (\text{Equation 16-26})$$

where:  $12 \leq L_r \leq 20$

For SI:  $L_r = L_o R_1 R_2$

where:  $0.58 \leq L_r \leq 0.96$

$L_o$  = Unreduced roof live load per square foot ( $\text{m}^2$ ) of horizontal projection supported by the member (see Table 1607.1).

$L_r$  = Reduced roof live load per square foot ( $\text{m}^2$ ) of horizontal projection supported by the member.

The reduction factors  $R_1$  and  $R_2$  shall be determined as follows:

$$R_1 = 1 \text{ for } A_t \leq 200 \text{ square feet (18.58 m}^2\text{)} \quad (\text{Equation 16-27})$$

$$R_1 = 1.2 - 0.001A_t \text{ for } 200 \text{ square feet} < A_t < 600 \text{ square feet} \quad (\text{Equation 16-28})$$

$$\text{For SI: } 1.2 - 0.011A_t \text{ for } 18.58 \text{ square meters} < A_t < 55.74 \text{ square meters}$$

$$R_1 = 0.6 \text{ for } A_t \geq 600 \text{ square feet (55.74 m}^2\text{)} \quad (\text{Equation 16-29})$$

where:

$A_t$  = Tributary area (span length multiplied by effective width) in square feet ( $\text{m}^2$ ) supported by the member, and

$$R_2 = 1 \text{ for } F \leq 4 \quad (\text{Equation 16-30})$$

$$R_2 = 1.2 - 0.05 F \text{ for } 4 < F < 12 \quad (\text{Equation 16-31})$$

$$R_2 = 0.6 \text{ for } F \geq 12 \quad (\text{Equation 16-32})$$

where:

$F$  = For a sloped roof, the number of inches of rise per foot (for SI:  $F = 0.12 \times \text{slope}$ , with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

**1607.12.3 Occupiable roofs.** Areas of roofs that are occupiable, such as roof gardens, or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.10.

**1607.12.3.1 Landscaped roofs.** The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf ( $0.958 \text{ kN/m}^2$ ). The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

**1607.12.4 Awnings and canopies.** Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for snow loads and wind loads as specified in Sections 1608 and 1609.

**1607.13 Crane loads.** The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

**1607.13.1 Maximum wheel load.** The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

**1607.13.2 Vertical impact force.** The maximum wheel loads of the crane shall be increased by the percentages

shown below to determine the induced vertical impact or vibration force:

Monorail cranes (powered) . . . . .	25 percent
Cab-operated or remotely operated bridge cranes (powered) . . . . .	25 percent
Pendant-operated bridge cranes (powered) . . . . .	10 percent
Bridge cranes or monorail cranes with hand-gear bridge, trolley and hoist. . . . .	0 percent

**1607.13.3 Lateral force.** The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with due regard to the lateral stiffness of the runway beam and supporting structure.

**1607.13.4 Longitudinal force.** The longitudinal force on crane runway beams, except for bridge cranes with hand-gear bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

**1607.14 Interior walls and partitions.** Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m<sup>2</sup>).

**Exception:** Fabric partitions complying with Section 1607.14.1 shall not be required to resist the minimum horizontal load of 5 psf (0.24 kN/m<sup>2</sup>).

**1607.14.1 Fabric partitions.** Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the following load conditions:

1. A horizontal distributed load of 5 psf (0.24 kN/m<sup>2</sup>) applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch diameter (203 mm) area [50.3 square inches (32 452 mm<sup>2</sup>)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

## SECTION 1608 SNOW LOADS

**1608.1 General.** Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall not be less than that determined by Section 1607.

**1608.2 Ground snow loads.** The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figure 1608.2 for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be made in areas designated "CS" in Figure 1608.2. Ground snow loads for sites at elevations above the limits indicated in Figure 1608.2 and for all sites within the CS areas shall be approved. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval). Snow loads are zero for Hawaii, except in mountainous regions as approved by the building official.

**1608.3 Ponding instability.** Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Section 7.11 of ASCE 7.

TABLE 1608.2  
GROUND SNOW LOADS,  $p_g$ , FOR ALASKAN LOCATIONS

LOCATION	POUNDS PER SQUARE FOOT	LOCATION	POUNDS PER SQUARE FOOT	LOCATION	POUNDS PER SQUARE FOOT
Adak	30	Galena	60	Petersburg	150
Anchorage	50	Gulkana	70	St. Paul Islands	40
Angoon	70	Homer	40	Seward	50
Barrow	25	Juneau	60	Shemya	25
Barter Island	35	Kenai	70	Sitka	50
Bethel	40	Kodiak	30	Talkeetna	120
Big Delta	50	Kotzebue	60	Unalakleet	50
Cold Bay	25	McGrath	70	Valdez	160
Cordova	100	Nenana	80	Whittier	300
Fairbanks	60	Nome	70	Wrangell	60
Fort Yukon	60	Palmer	50	Yakutat	150

For SI: 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.



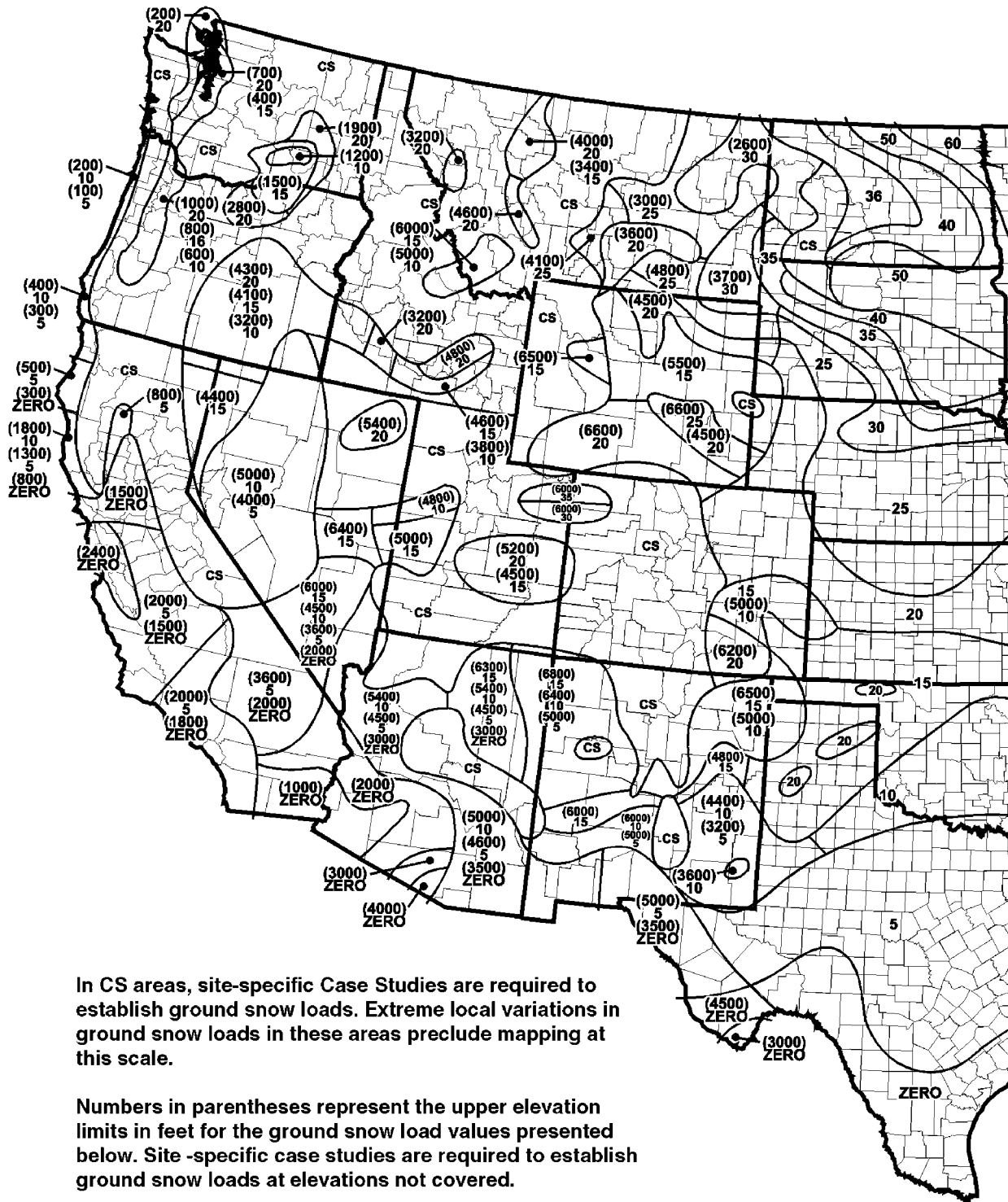


FIGURE 1608.2  
GROUND SNOW LOADS,  $p_g$ , FOR THE UNITED STATES (psf)



FIGURE 1608.2—continued  
GROUND SNOW LOADS,  $p_g$ , FOR THE UNITED STATES (psf)

## SECTION 1609 WIND LOADS

**1609.1 Applications.** Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

**1609.1.1 Determination of wind loads.** Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7 or provisions of the alternate all-heights method in Section 1609.6. The type of opening protection required, the ultimate design wind speed,  $V_{ult}$ , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

### Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AF&PA WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with Chapter 31 of ASCE 7.

The wind speeds in Figures 1609A, 1609B and 1609C are ultimate design wind speeds,  $V_{ult}$ , and shall be converted in accordance with Section 1609.3.1 to nominal design wind speeds,  $V_{asd}$ , when the provisions of the standards referenced in Exceptions 1 through 5 are used.

**1609.1.1.1 Applicability.** The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of ICC 600, AF&PA WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;
2. The maximum average slope of the hill exceeds 10 percent; and
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a

distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.

**1609.1.2 Protection of openings.** In wind-borne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E 1996 and ASTM E 1886 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E 1996.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E 1996.

### Exceptions:

1. Wood structural panels with a minimum thickness of  $\frac{7}{16}$  inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings classified as Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.1.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where  $V_{asd}$  determined in accordance with Section 1609.3.1 does not exceed 140 mph (63 m/s).
2. Glazing in Risk Category I buildings as defined in Section 1604.5, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Risk Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

**1609.1.2.1 Louvers.** Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 54.

**TABLE 1609.1.2**  
**WIND-BORNE DEBRIS PROTECTION FASTENING SCHEDULE**  
**FOR WOOD STRUCTURAL PANELS<sup>a, b, c, d</sup>**

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
<sup>1</sup> / <sub>4</sub> -inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

- This table is based on 140 mph wind speeds and a 45-foot mean roof height.
- Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located a minimum of 1 inch from the edge of the panel.
- Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located a minimum of 2<sup>1</sup>/<sub>2</sub> inches from the edge of concrete block or concrete.
- Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

**1609.1.2.2 Application of ASTM E 1996.** The text of Section 6.2.2 of ASTM E 1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the strength design wind speed,  $V_{ult}$ , as follows:

6.2.2.1 *Wind Zone 1*—130 mph ≤ ultimate design wind speed,  $V_{ult}$  < 140 mph.

6.2.2.2 *Wind Zone 2*—140 mph ≤ ultimate design wind speed,  $V_{ult}$  < 150 mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 *Wind Zone 3*—150 mph (58 m/s) ≤ ultimate design wind speed,  $V_{ult}$  ≤ 160 mph (63 m/s), or 140 mph (54 m/s) ≤ ultimate design wind speed,  $V_{ult}$  ≤ 160 mph (63 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 *Wind Zone 4*—ultimate design wind speed,  $V_{ult}$  > 160 mph (63 m/s).

**1609.1.2.3 Garage doors.** Garage door glazed opening protection for wind-borne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

**1609.2 Definitions.** For the purposes of Section 1609 and as used elsewhere in this code, the following terms are defined in Chapter 2.

### HURRICANE-PRONE REGIONS.

### WIND-BORNE DEBRIS REGION.

### WIND SPEED, $V_{ult}$ .

### WIND SPEED, $V_{asd}$ .

**1609.3 Basic wind speed.** The ultimate design wind speed,  $V_{ult}$ , in mph, for the determination of the wind loads shall be determined by Figures 1609A, 1609B and 1609C. The ultimate design wind speed,  $V_{ult}$ , for use in the design of Risk Category II buildings and structures shall be obtained from Figure 1609A. The ultimate design wind speed,  $V_{ult}$ , for use in the design of Risk Category III and IV buildings and structures shall be obtained from Figure 1609B. The ultimate design wind speed,  $V_{ult}$ , for use in the design of Risk Category I buildings and structures shall be obtained from Figure 1609C. The ultimate design wind speed,  $V_{ult}$ , for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The ultimate design wind speeds,  $V_{ult}$ , determined by the local jurisdiction shall be in accordance with Section 26.5.1 of ASCE 7.

In nonhurricane-prone regions, when the ultimate design wind speed,  $V_{ult}$ , is estimated from regional climatic data, the ultimate design wind speed,  $V_{ult}$ , shall be determined in accordance with Section 26.5.3 of ASCE 7.

**1609.3.1 Wind speed conversion.** When required, the ultimate design wind speeds of Figures 1609A, 1609B and 1609C shall be converted to nominal design wind speeds,  $V_{asd}$ , using Table 1609.3.1 or Equation 16-33.

$$V_{asd} = V_{ult} \sqrt{0.6} \quad \text{(Equation 16-33)}$$

where:

$V_{asd}$  = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.

$V_{ult}$  = ultimate design wind speeds determined from Figures 1609A, 1609B or 1609C.

**TABLE 1609.3.1**  
**WIND SPEED CONVERSIONS<sup>a, b, c</sup>**

$V_{ult}$	100	110	120	130	140	150	160	170	180	190	200
$V_{asd}$	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

- Linear interpolation is permitted.
- $V_{asd}$  = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.
- $V_{ult}$  = ultimate design wind speeds determined from Figures 1609A, 1609B, or 1609C.



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FIGURE 1609B  
ULTIMATE DESIGN WIND SPEEDS,  $V_{u,T}$ , FOR RISK CATEGORY III AND IV BUILDINGS AND OTHER STRUCTURES

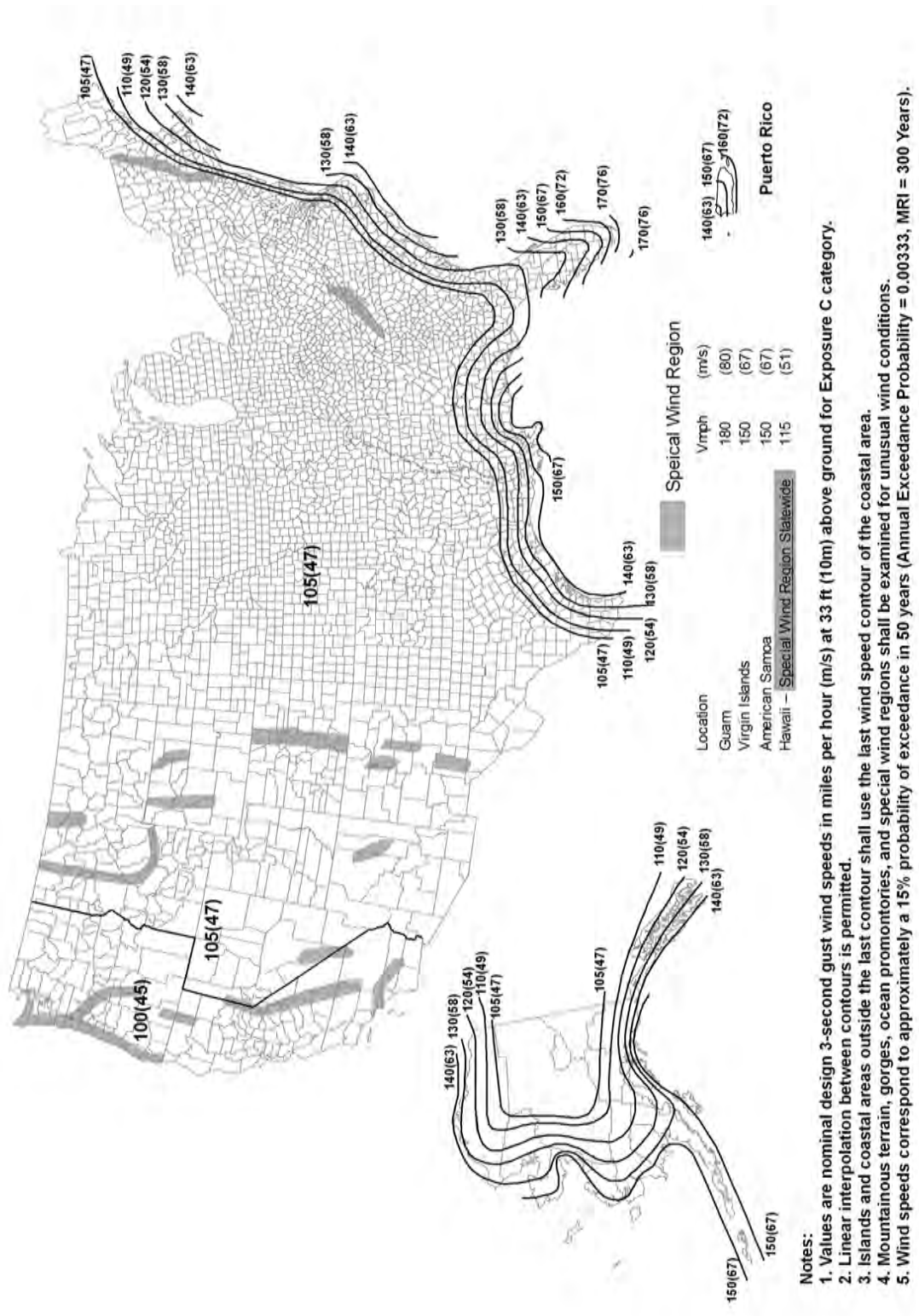


FIGURE 1609C  
ULTIMATE DESIGN WIND SPEEDS,  $V_{UL,T}$ , FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES

**1609.4 Exposure category.** For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

**1609.4.1 Wind directions and sectors.** For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

**1609.4.2 Surface roughness categories.** A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

**Surface Roughness B.** Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

**Surface Roughness C.** Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

**Surface Roughness D.** Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

**1609.4.3 Exposure categories.** An exposure category shall be determined in accordance with the following:

**Exposure B.** For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

**Exposure C.** Exposure C shall apply for all cases where Exposures B or D do not apply.

**Exposure D.** Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall also apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building

height, whichever is greater, from an exposure D condition as defined in the previous sentence.

**1609.5 Roof systems.** Roof systems shall be designed and constructed in accordance with Sections 1609.5.1 through 1609.5.3, as applicable.

**1609.5.1 Roof deck.** The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

**1609.5.2 Roof coverings.** Roof coverings shall comply with Section 1609.5.1.

**Exception:** Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall comply with the wind-resistance requirements of Section 1507.2.7.1.

**1609.5.3 Rigid tile.** Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - G C_p] \quad (\text{Equation 16-34})$$

For SI:

$$M_a = \frac{q_h C_L b L L_a [1.0 - G C_p]}{1,000}$$

where:

$b$  = Exposed width, feet (mm) of the roof tile.

$C_L$  = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1711.2.

$G C_p$  = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

$L$  = Length, feet (mm) of the roof tile.

$L_a$  = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

$M_a$  = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.



$q_h$  = Wind velocity pressure, psf (kN/m<sup>2</sup>) determined from Section 27.3.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing which has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have at least two-thirds of the tile's area free of mortar or adhesive contact.

**1609.6 Alternate all-heights method.** The alternate wind design provisions in this section are simplifications of the ASCE 7 Directional Procedure.

**1609.6.1 Scope.** As an alternative to ASCE 7 Chapters 27 and 30, the following provisions are permitted to be used to determine the wind effects on regularly shaped buildings, or other structures that are regularly shaped, which meet all of the following conditions:

1. The building or other structure is less than or equal to 75 feet (22 860 mm) in height with a height-to-least-width ratio of 4 or less, or the building or other structure has a fundamental frequency greater than or equal to 1 hertz.
2. The building or other structure is not sensitive to dynamic effects.
3. The building or other structure is not located on a site for which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.
4. The building shall meet the requirements of a simple diaphragm building as defined in ASCE 7 Section 26.2, where wind loads are only transmitted to the main windforce-resisting system (MWFRS) at the diaphragms.
5. For open buildings, multspan gable roofs, stepped roofs, sawtooth roofs, domed roofs, roofs with

slopes greater than 45 degrees (0.79 rad), solid free-standing walls and solid signs, and rooftop equipment, apply ASCE 7 provisions.

**1609.6.1.1 Modifications.** The following modifications shall be made to certain subsections in ASCE 7: in Section 1609.6.2, symbols and notations that are specific to this section are used in conjunction with the symbols and notations in ASCE 7 Section 26.3.

**1609.6.2 Symbols and notations.** Coefficients and variables used in the alternative all-heights method equations are as follows:

$C_{net}$  = Net-pressure coefficient based on  $K_d [(G) (C_p) - (GC_{pi})]$ , in accordance with Table 1609.6.2.

$G$  = Gust effect factor for rigid structures in accordance with ASCE 7 Section 26.9.1.

$K_d$  = Wind directionality factor in accordance with ASCE 7 Table 26-6.

$P_{net}$  = Design wind pressure to be used in determination of wind loads on buildings or other structures or their components and cladding, in psf (kN/m<sup>2</sup>).

**1609.6.3 Design equations.** When using the alternative all-heights method, the MWFRS, and components and cladding of every structure shall be designed to resist the effects of wind pressures on the building envelope in accordance with Equation 16-35.

$$P_{net} = 0.00256V^2K_zC_{net}K_{zt} \quad \text{(Equation 16-35)}$$

Design wind forces for the MWFRS shall not be less than 16 psf (0.77 kN/m<sup>2</sup>) multiplied by the area of the structure projected on a plane normal to the assumed wind direction (see ASCE 7 Section 27.4.7 for criteria). Design net wind pressure for components and cladding shall not be less than 16 psf (0.77 kN/m<sup>2</sup>) acting in either direction normal to the surface.

**1609.6.4 Design procedure.** The MWFRS and the components and cladding of every building or other structure shall be designed for the pressures calculated using Equation 16-35.

**1609.6.4.1 Main windforce-resisting systems.** The MWFRS shall be investigated for the torsional effects identified in ASCE 7 Figure 27.4.6.

**1609.6.4.2 Determination of  $K_z$  and  $K_{zt}$ .** Velocity pressure exposure coefficient,  $K_z$ , shall be determined in accordance with ASCE 7 Section 27.3.1 and the topographic factor,  $K_{zt}$ , shall be determined in accordance with ASCE 7 Section 26.8.

1. For the windward side of a structure,  $K_{zt}$  and  $K_z$  shall be based on height  $z$ .
2. For leeward and sidewalls, and for windward and leeward roofs,  $K_{zt}$  and  $K_z$  shall be based on mean roof height  $h$ .

**TABLE 1609.6.2**  
**NET PRESSURE COEFFICIENTS,  $C_{net}^{a,b}$**

STRUCTURE OR PART THEREOF	DESCRIPTION		$C_{net}$ FACTOR			
			Enclosed		Partially enclosed	
1. Main windforce-resisting frames and systems	<b>Walls:</b>		<b>+ Internal pressure</b>	<b>- Internal pressure</b>	<b>+ Internal pressure</b>	<b>- Internal pressure</b>
	Windward wall		0.43	0.73	0.11	1.05
	Leeward wall		-0.51	-0.21	-0.83	0.11
	Sidewall		-0.66	-0.35	-0.97	-0.04
	Parapet wall	Windward	1.28		1.28	
		Leeward	-0.85		-0.85	
	<b>Roofs:</b>		Enclosed		Partially enclosed	
	Wind perpendicular to ridge		<b>+ Internal pressure</b>	<b>- Internal pressure</b>	<b>+ Internal pressure</b>	<b>- Internal pressure</b>
	Leeward roof or flat roof		-0.66	-0.35	-0.97	-0.04
	Windward roof slopes:					
	Slope < 2:12 (10°)	Condition 1	-1.09	-0.79	-1.41	-0.47
		Condition 2	-0.28	0.02	-0.60	0.34
	Slope = 4:12 (18°)	Condition 1	-0.73	-0.42	-1.04	-0.11
		Condition 2	-0.05	0.25	-0.37	0.57
	Slope = 5:12 (23°)	Condition 1	-0.58	-0.28	-0.90	0.04
		Condition 2	0.03	0.34	-0.29	0.65
	Slope = 6:12 (27°)	Condition 1	-0.47	-0.16	-0.78	0.15
		Condition 2	0.06	0.37	-0.25	0.68
	Slope = 7:12 (30°)	Condition 1	-0.37	-0.06	-0.68	0.25
		Condition 2	0.07	0.37	-0.25	0.69
	Slope = 9:12 (37°)	Condition 1	-0.27	0.04	-0.58	0.35
		Condition 2	0.14	0.44	-0.18	0.76
	Slope = 12:12 (45°)		0.14	0.44	-0.18	0.76
	Wind parallel to ridge and flat roofs		-1.09	-0.79	-1.41	-0.47
	<b>Nonbuilding Structures: Chimneys, Tanks and Similar Structures:</b>					
			h/D			
			1	7	25	
	Square (Wind normal to face)		0.99	1.07	1.53	
	Square (Wind on diagonal)		0.77	0.84	1.15	
	Hexagonal or Octagonal		0.81	0.97	1.13	
	Round		0.65	0.81	0.97	
	Open signs and lattice frameworks		Ratio of solid to gross area			
			< 0.1	0.1 to 0.29	0.3 to 0.7	
	Flat		1.45	1.30	1.16	
	Round		0.87	0.94	1.08	

(continued)

**TABLE 1609.6.2—continued**  
**NET PRESSURE COEFFICIENTS,  $C_{net}$ <sup>a, b</sup>**

STRUCTURE OR PART THEREOF	DESCRIPTION		$C_{net}$ FACTOR	
			Enclosed	Partially enclosed
2. Components and cladding not in areas of discontinuity—roofs and overhangs	<b>Roof elements and slopes</b>		<b>Enclosed</b>	<b>Partially enclosed</b>
	Gable of hipped configurations (Zone 1)			
	Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 1			
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.00	-1.32
		100 square feet or more	-0.92	-1.23
	Overhang: Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2A Zone 1			
	Negative	10 square feet or less	-1.45	
		100 square feet or more	-1.36	
		500 square feet or more	-0.94	
	6:12 (27°) < Slope < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 1			
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.00	-1.32
		100 square feet or more	-0.83	-1.15
	Monosloped configurations (Zone 1)		<b>Enclosed</b>	<b>Partially enclosed</b>
	Flat < Slope < 7:12 (30°) See ASCE 7 Figure 30.4-5B Zone 1			
	Positive	10 square feet or less	0.49	0.81
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.26	-1.57
		100 square feet or more	-1.09	-1.40
	Tall flat-topped roofs $h > 60$ feet		<b>Enclosed</b>	<b>Partially enclosed</b>
	Flat < Slope < 2:12 (10°) (Zone 1) See ASCE 7 Figure 30.8-1 Zone 1			
	Negative	10 square feet or less	-1.34	-1.66
		500 square feet or more	-0.92	-1.23
3. Components and cladding in areas of discontinuities—roofs and overhangs (continued)	Gable or hipped configurations at ridges, eaves and rakes (Zone 2)			
	Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 2			
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	10.72
	Negative	10 square feet or less	-1.68	-2.00
		100 square feet or more	-1.17	-1.49
	Overhang for Slope Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 2			
	Negative	10 square feet or less	-1.87	
		100 square feet or more	-1.87	
	6:12 (27°) < Slope < 12:12 (45°) Figure 30.4-2C		<b>Enclosed</b>	<b>Partially enclosed</b>
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.17	-1.49
		100 square feet or more	-1.00	-1.32
	Overhang for 6:12 (27°) < Slope < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 2			
	Negative	10 square feet or less	-1.70	
		500 square feet or more	-1.53	

(continued)

**TABLE 1609.6.2—continued**  
**NET PRESSURE COEFFICIENTS,  $C_{net}$ <sup>a, b</sup>**

STRUCTURE OR PART THEREOF	DESCRIPTION	$C_{net}$ FACTOR	
		Enclosed	Partially enclosed
3. Components and cladding in areas of discontinuities—roofs and overhangs	<b>Roof elements and slopes</b>		
	Monosloped configurations at ridges, eaves and rakes (Zone 2)		
	Flat < Slope < 7:12 (30°) See ASCE 7 Figure 30.4-5B Zone 2		
	Positive	10 square feet or less	0.49
		100 square feet or more	0.41
	Negative	10 square feet or less	-1.51
		100 square feet or more	-1.43
	Tall flat topped roofs $h > 60$ feet	Enclosed	Partially enclosed
	Flat < Slope < 2:12 (10°) (Zone 2) See ASCE 7 Figure 30.8-1 Zone 2		
	Negative	10 square feet or less	-2.11
		500 square feet or more	-1.51
	Gable or hipped configurations at corners (Zone 3) See ASCE 7 Figure 30.4-2B Zone 3		
	Flat < Slope < 6:12 (27°)	Enclosed	Partially enclosed
	Positive	10 square feet or less	0.58
		100 square feet or more	0.41
	Negative	10 square feet or less	-2.53
		100 square feet or more	-1.85
	Overhang for Slope Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 3		
	Negative	10 square feet or less	-3.15
		100 square feet or more	-2.13
	6:12 (27°) < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 3		
	Positive	10 square feet or less	0.92
		100 square feet or more	0.83
	Negative	10 square feet or less	-1.17
		100 square feet or more	-1.00
	Overhang for 6:12 (27°) < Slope < 12:12 (45°)	Enclosed	Partially enclosed
	Negative	10 square feet or less	-1.70
		100 square feet or more	-1.53
	Monosloped Configurations at corners (Zone 3) See ASCE 7 Figure 30.4-5B Zone 3		
	Flat < Slope < 7:12 (30°)		
	Positive	10 square feet or less	0.49
		100 square feet or more	0.41
	Negative	10 square feet or less	-2.62
		100 square feet or more	-1.85
	Tall flat topped roofs $h > 60$ feet	Enclosed	Partially enclosed
	Flat < Slope < 2:12 (10°) (Zone 3) See ASCE 7 Figure 30.8-1 Zone 3		
	Negative	10 square feet or less	-2.87
		500 square feet or more	-2.11
4. Components and cladding not in areas of discontinuity—walls and parapets (continued)	Wall Elements: $h = 60$ feet (Zone 4) Figure 30.4-1	Enclosed	Partially enclosed
	Positive	10 square feet or less	1.00
		500 square feet or more	0.75
	Negative	10 square feet or less	-1.09
		500 square feet or more	-0.83
	Wall Elements: $h > 60$ feet (Zone 4) See ASCE 7 Figure 30.8-1 Zone 4		

**TABLE 1609.6.2—continued**  
**NET PRESSURE COEFFICIENTS,  $C_{net}$** <sup>a, b</sup>

STRUCTURE OR PART THEREOF	DESCRIPTION		$C_{net}$ FACTOR	
4. Components and cladding not in areas of discontinuity—walls and parapets	Negative	20 square feet or less	-0.92	-1.23
		500 square feet or more	-0.75	-1.06
	Parapet Walls			
	Positive		2.87	3.19
5. Components and cladding in areas of discontinuity—walls and parapets	Negative		-1.68	-2.00
	Wall elements: $h \leq 60$ feet (Zone 5) Figure 30.4-1		Enclosed	Partially enclosed
	Positive	10 square feet or less	1.00	1.32
		500 square feet or more	0.75	1.06
	Negative	10 square feet or less	-1.34	-1.66
		500 square feet or more	-0.83	-1.15
	Wall elements: $h > 60$ feet (Zone 5) See ASCE 7 Figure 30.8-1 Zone 4			
	Positive	20 square feet or less	0.92	1.23
		500 square feet or more	0.66	0.98
	Negative	20 square feet or less	-1.68	-2.00
		500 square feet or more	-1.00	-1.32
	Parapet walls			
	Positive		3.64	3.95
	Negative		-2.45	-2.76

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929m<sup>2</sup>, 1 degree = 0.0175 rad.

a. Linear interpolation between values in the table is permitted.

b. Some  $C_{net}$  values have been grouped together. Less conservative results may be obtained by applying ASCE 7 provisions.

**1609.6.4.3 Determination of net pressure coefficients,  $C_{net}$ .** For the design of the MWFRS and for components and cladding, the sum of the internal and external net pressure shall be based on the net pressure coefficient,  $C_{net}$ .

1. The pressure coefficient,  $C_{net}$ , for walls and roofs shall be determined from Table 1609.6.2.
2. Where  $C_{net}$  has more than one value, the more severe wind load condition shall be used for design.

**1609.6.4.4 Application of wind pressures.** When using the alternative all-heights method, wind pressures shall be applied simultaneously on, and in a direction normal to, all building envelope wall and roof surfaces.

**1609.6.4.4.1 Components and cladding.** Wind pressure for each component or cladding element is applied as follows using  $C_{net}$  values based on the effective wind area,  $A$ , contained within the zones in areas of discontinuity of width and/or length “a,” “2a” or “4a” at: corners of roofs and walls; edge strips for ridges, rakes and eaves; or field areas on walls or roofs as indicated in figures in tables in ASCE 7 as referenced in Table 1609.6.2 in accordance with the following:

1. Calculated pressures at local discontinuities acting over specific edge strips or corner boundary areas.

2. Include “field” (Zone 1, 2 or 4, as applicable) pressures applied to areas beyond the boundaries of the areas of discontinuity.
3. Where applicable, the calculated pressures at discontinuities (Zone 2 or 3) shall be combined with design pressures that apply specifically on rakes or eave overhangs.

## SECTION 1610 SOIL LATERAL LOADS

**1610.1 General.** Foundation walls and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils at the site are expansive. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805.4.2 and 1805.4.3.

**Exception:** Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the

top by flexible diaphragms shall be permitted to be designed for active pressure.

### SECTION 1611 RAIN LOADS

**1611.1 Design rain loads.** Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow. The design rainfall shall be based on the 100-year hourly rainfall rate indicated in Figure 1611.1 or on other rainfall rates determined from approved local weather data.

$$R = 5.2(d_s + d_h) \quad (\text{Equation 16-36})$$

For SI:  $R = 0.0098(d_s + d_h)$

where:

$d_h$  = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (i.e., the hydraulic head), in inches (mm).

$d_s$  = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary

drainage system is blocked (i.e., the static head), in inches (mm).

$R$  = Rain load on the undeflected roof, in psf (kN/m<sup>2</sup>). When the phrase “undeflected roof” is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

**1611.2 Ponding instability.** Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Section 8.4 of ASCE 7.

**1611.3 Controlled drainage.** Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611.1. Such roofs shall also be checked for ponding instability in accordance with Section 1611.2.

**TABLE 1610.1  
LATERAL SOIL LOAD**

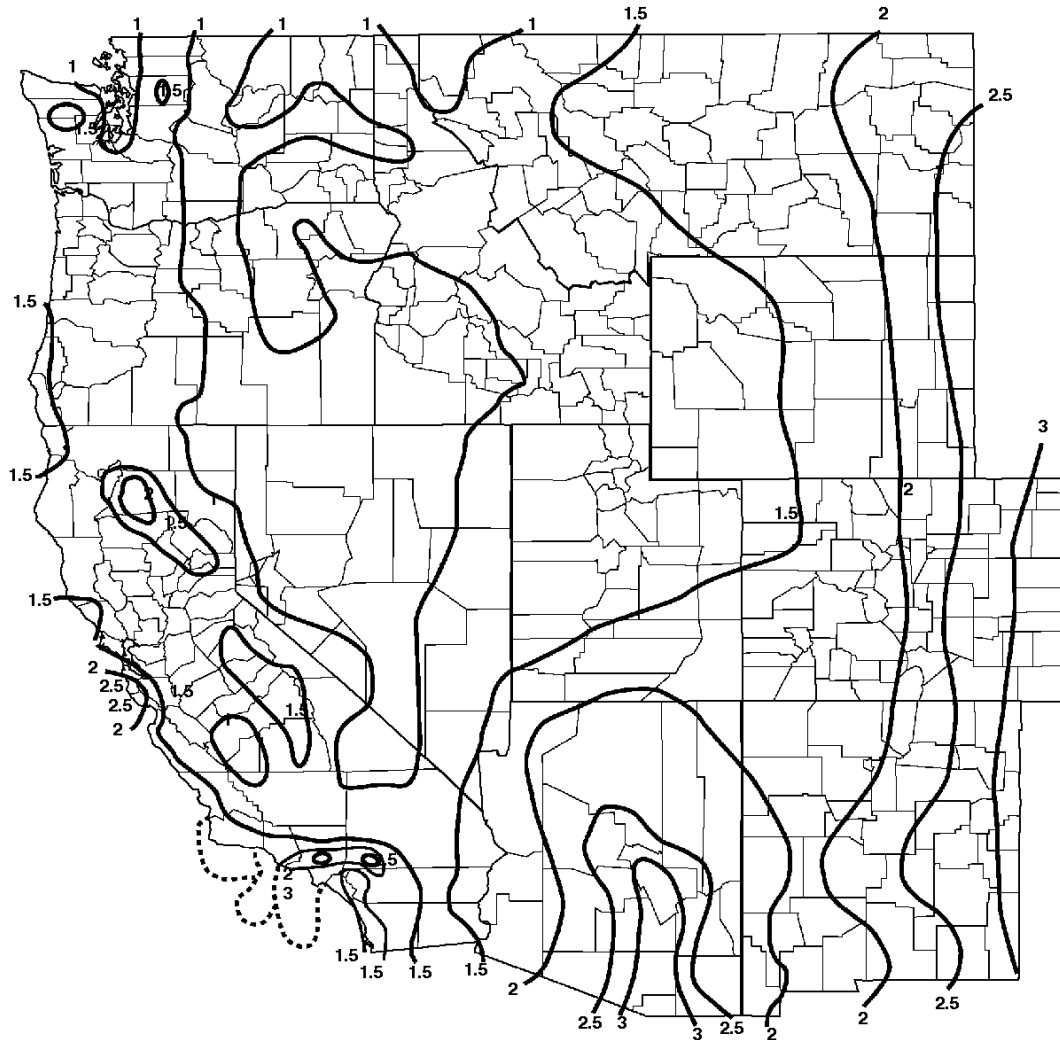
DESCRIPTION OF BACKFILL MATERIAL <sup>c</sup>	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD <sup>a</sup> (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.

b. Unsuitable as backfill material.

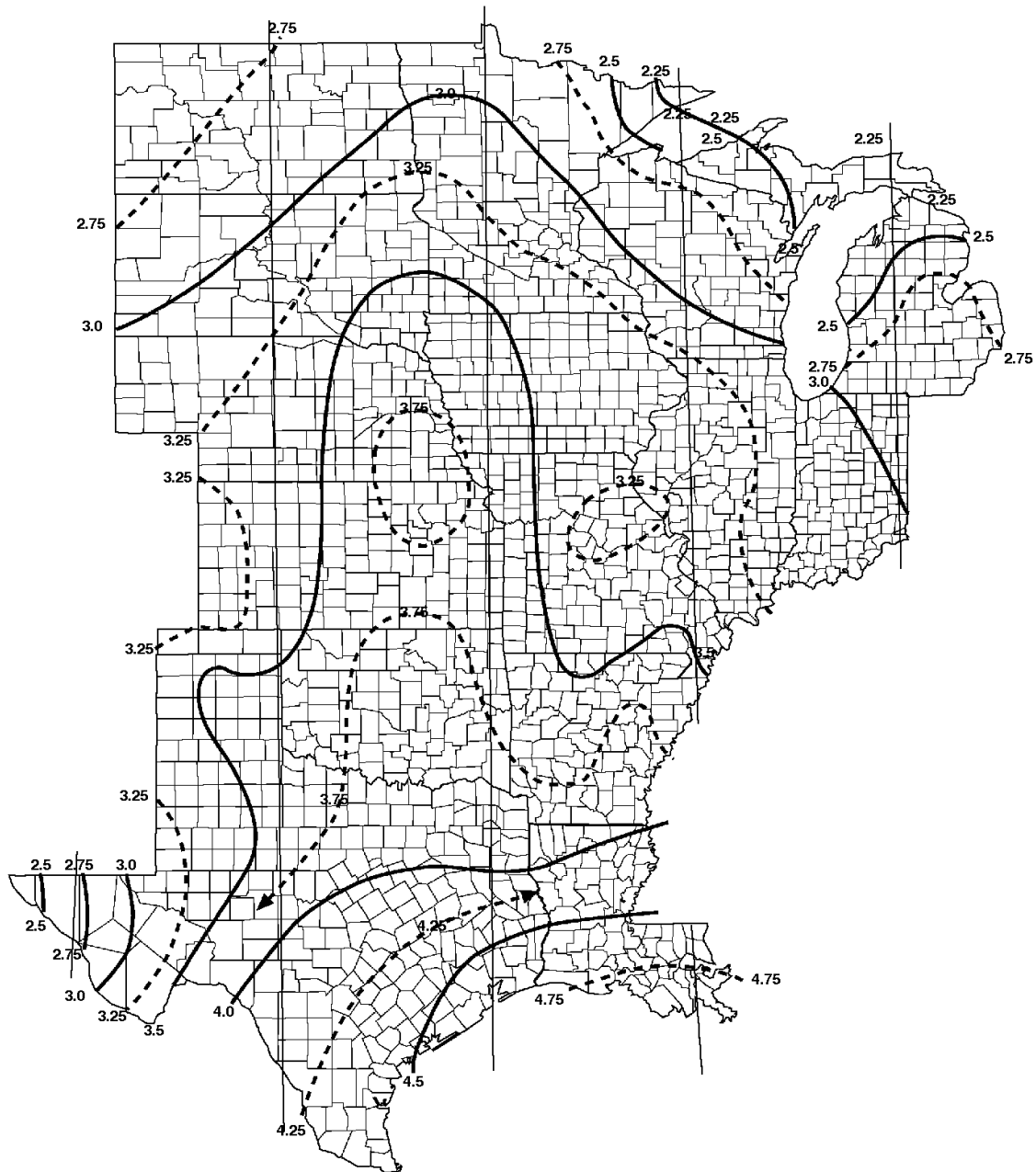
c. The definition and classification of soil materials shall be in accordance with ASTM D 2487.



[P] FIGURE 1611.1  
100-YEAR, 1-HOUR RAINFALL (INCHES) WESTERN UNITED STATES

For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611.1—continued  
 100-YEAR, 1-HOUR RAINFALL (INCHES) CENTRAL UNITED STATES

For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

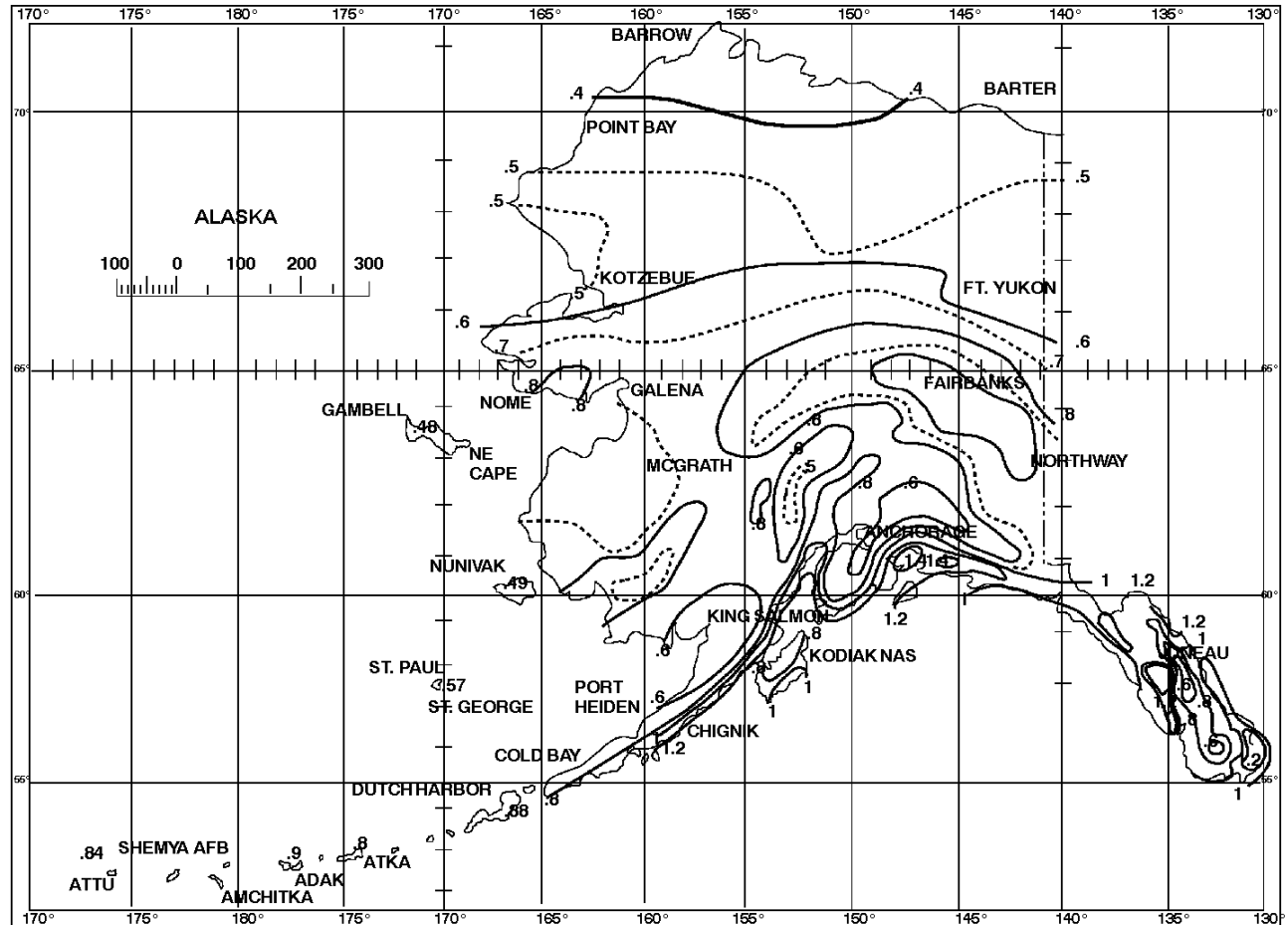




[P] FIGURE 1611.1—continued  
100-YEAR, 1-HOUR RAINFALL (INCHES) EASTERN UNITED STATES

For SI: 1 inch = 25.4 mm.

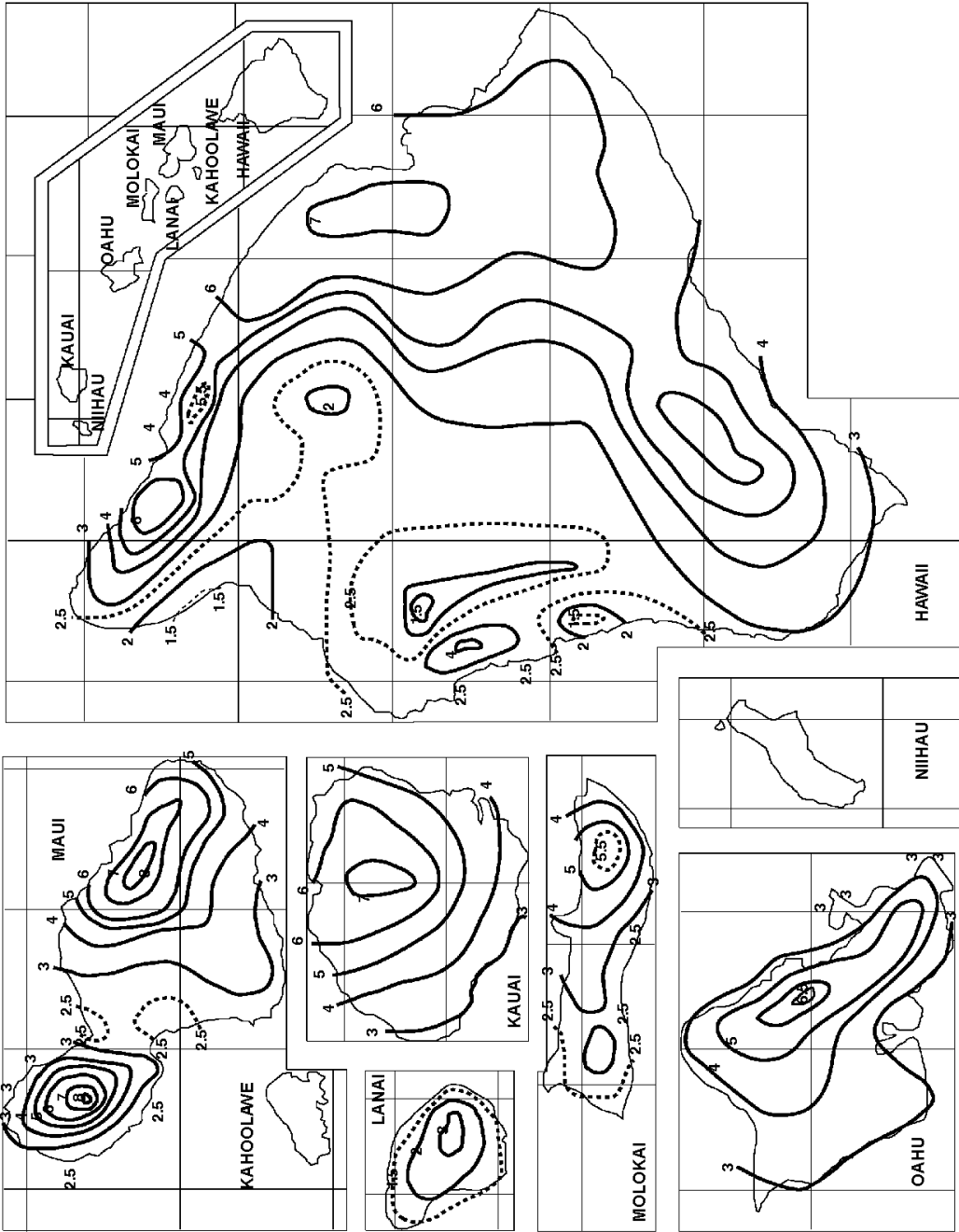
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



**[P] FIGURE 1611.1—continued  
100-YEAR, 1-HOUR RAINFALL (INCHES) ALASKA**

For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611.1—continued  
100-YEAR, 1-HOUR RAINFALL (INCHES) HAWAII

For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

## SECTION 1612 FLOOD LOADS

**1612.1 General.** Within flood hazard areas as established in Section 1612.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

**1612.2 Definitions.** The following terms are defined in Chapter 2:

**BASE FLOOD.**

**BASE FLOOD ELEVATION.**

**BASEMENT.**

**DESIGN FLOOD.**

**DESIGN FLOOD ELEVATION.**

**DRY FLOODPROOFING.**

**EXISTING CONSTRUCTION.**

**EXISTING STRUCTURE.**

**FLOOD or FLOODING.**

**FLOOD DAMAGE-RESISTANT MATERIALS.**

**FLOOD HAZARD AREA.**

**FLOOD HAZARD AREA SUBJECT TO HIGH-VELOCITY WAVE ACTION.**

**FLOOD INSURANCE RATE MAP (FIRM).**

**FLOOD INSURANCE STUDY.**

**FLOODWAY.**

**LOWEST FLOOR.**

**SPECIAL FLOOD HAZARD AREA.**

**START OF CONSTRUCTION.**

**SUBSTANTIAL DAMAGE.**

**SUBSTANTIAL IMPROVEMENT.**

**1612.3 Establishment of flood hazard areas.** To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency in an engineering report entitled "The Flood Insurance Study for [INSERT NAME OF JURISDICTION]," dated [INSERT DATE OF ISSUANCE], as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

***Exception:** [OSHDP 2] The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's Flood Insurance Study (FIS) adopted by the*

*local authority having jurisdiction where the project is located.*

**1612.3.1 Design flood elevations.** Where design flood elevations are not included in the flood hazard areas established in Section 1612.3, or where floodways are not designated, the building official is authorized to require the applicant to:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source; or
2. Determine the design flood elevation and/or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

**1612.3.2 Determination of impacts.** In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

**1612.4 Design and construction.** The design and construction of buildings and structures located in flood hazard areas, including flood hazard areas subject to high-velocity wave action, shall be in accordance with Chapter 5 of ASCE 7 and with ASCE 24.

**1612.5 Flood hazard documentation.** The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas not subject to high-velocity wave action:
  - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3, *Chapter 1, Division II*.
  - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.6.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.6.2.2 of ASCE 24.
  - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.
2. For construction in flood hazard areas subject to high-velocity wave action:
  - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the

lowest floor elevation inspection in Section 110.3.3, *Chapter 1, Division II*.

- 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
- 2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m<sup>2</sup>) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

## SECTION 1613 EARTHQUAKE LOADS

**1613.1 Scope.** Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7, excluding Chapter 14 and Appendix 11A. The seismic design category for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

### Exceptions:

1. Detached one- and two-family dwellings, assigned to Seismic Design Category A, B or C, or located where the mapped short-period spectral response acceleration,  $S_s$ , is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section. *[OSHPD 2] Not permitted by OSHPD, see Section 2308.*
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers,

hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

5. *[OSHPD 2] Seismic Design Category shall be in accordance with exception to Section 1613.3.5.*

**1613.1.1 Scope. [SL]** For applications listed in Section 1.12 regulated by the State Librarian, only the provisions of ASCE 7 Tables 13.5-1 and 1607.1, as amended, of this code shall apply.

**1613.1.2 State-owned buildings.** State-owned buildings, including those of the University of California, CSU and Judicial Council, shall not be constructed where any portion of the foundation would be within a mapped area of earthquake-induced liquefaction of landsliding or within 50 feet of a mapped fault rupture hazard as established by Section 1803.7.

**1613.1.3 Existing state buildings.** Additions, alterations, repairs or change of occupancy category of existing buildings shall be in accordance with Chapter 34.

**1613.2 Definitions.** The following terms are defined in Chapter 2:

**DESIGN EARTHQUAKE GROUND MOTION.**

**MECHANICAL SYSTEMS.**

**ORTHOGONAL.**

**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE ( $MCE_R$ ) GROUND MOTION RESPONSE ACCELERATION.**

**SEISMIC DESIGN CATEGORY.**

**SEISMIC FORCE-RESISTING SYSTEM.**

**SITE CLASS.**

**SITE COEFFICIENTS.**

**1613.3 Seismic ground motion values.** Seismic ground motion values shall be determined in accordance with this section.

**1613.3.1 Mapped acceleration parameters.** The parameters  $S_s$  and  $S_1$  shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures 1613.3.1(1) through 1613.3.1(6). Where  $S_1$  is less than or equal to 0.04 and  $S_s$  is less than or equal to 0.15, the structure is permitted to be assigned to *Seismic Design Category A*. The parameters  $S_s$  and  $S_1$  shall be, respectively, 1.5 and 0.6 for Guam and 1.0 and 0.4 for American Samoa.

**Exception:** *[OSHPD 2] Seismic Design Category shall be in accordance with exception to Section 1613.3.5.*

**TABLE 1613.3.3(1)  
VALUES OF SITE COEFFICIENT  $F_a$  <sup>a</sup>**

SITE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT SHORT PERIOD				
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period,  $S_s$ .

b. Values shall be determined in accordance with Section 11.4.7 of ASCE 7.

**1613.3.2 Site class definitions.** Based on the site soil properties, the site shall be classified as Site Class A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7. Where the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines Site Class E or F soils are present at the site.

**1613.3.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters.** The maximum considered earthquake spectral response acceleration for short periods,  $S_{MS}$ , and at 1-second period,  $S_{M1}$ , adjusted for site class effects shall be determined by Equations 16-37 and 16-38, respectively:

$$S_{MS} = F_a S_s \quad (\text{Equation 16-37})$$

$$S_{M1} = F_v S_1 \quad (\text{Equation 16-38})$$

where:

$F_a$  = Site coefficient defined in Table 1613.3.3(1).

$F_v$  = Site coefficient defined in Table 1613.3.3(2).

$S_s$  = The mapped spectral accelerations for short periods as determined in Section 1613.3.1.

$S_1$  = The mapped spectral accelerations for a 1-second period as determined in Section 1613.3.1.

**1613.3.4 Design spectral response acceleration parameters.** Five-percent damped design spectral response acceleration at short periods,  $S_{DS}$ , and at 1-second period,  $S_{D1}$ , shall be determined from Equations 16-39 and 16-40, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \quad (\text{Equation 16-39})$$

$$S_{D1} = \frac{2}{3} S_{M1} \quad (\text{Equation 16-40})$$

where:

$S_{MS}$  = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613.3.3.

$S_{M1}$  = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613.3.3.

**TABLE 1613.3.3(2)**  
**VALUES OF SITE COEFFICIENT  $F_v$  <sup>a</sup>**

SITE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIOD				
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 \geq 0.5$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period,  $S_1$ .

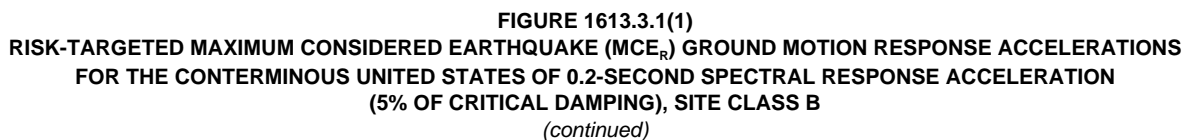
b. Values shall be determined in accordance with Section 11.4.7 of ASCE 7.

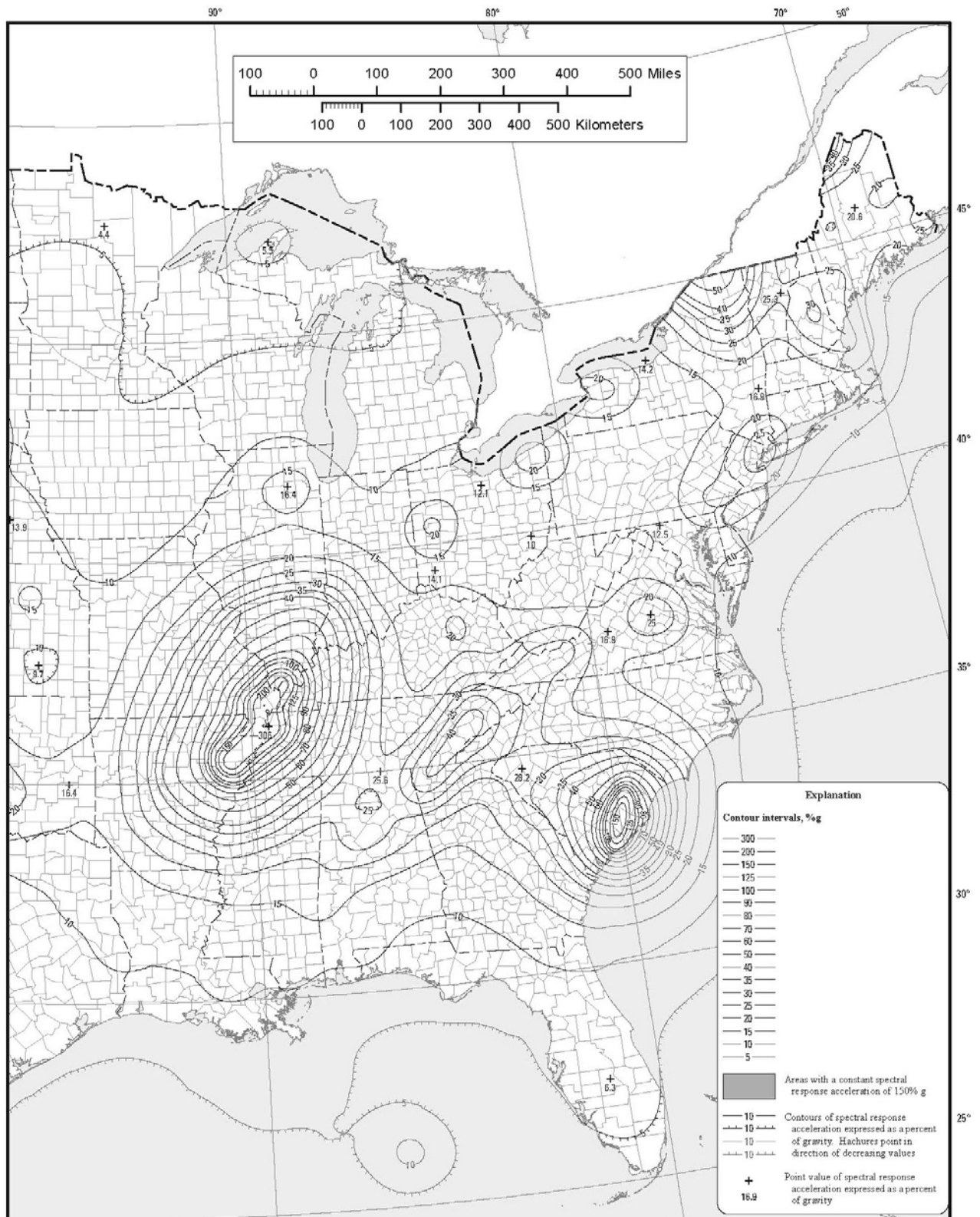
**TABLE 1613.3.5(1)**  
**SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATIONS**

VALUE OF $S_{DS}$	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

**TABLE 1613.3.5(2)**  
**SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION**

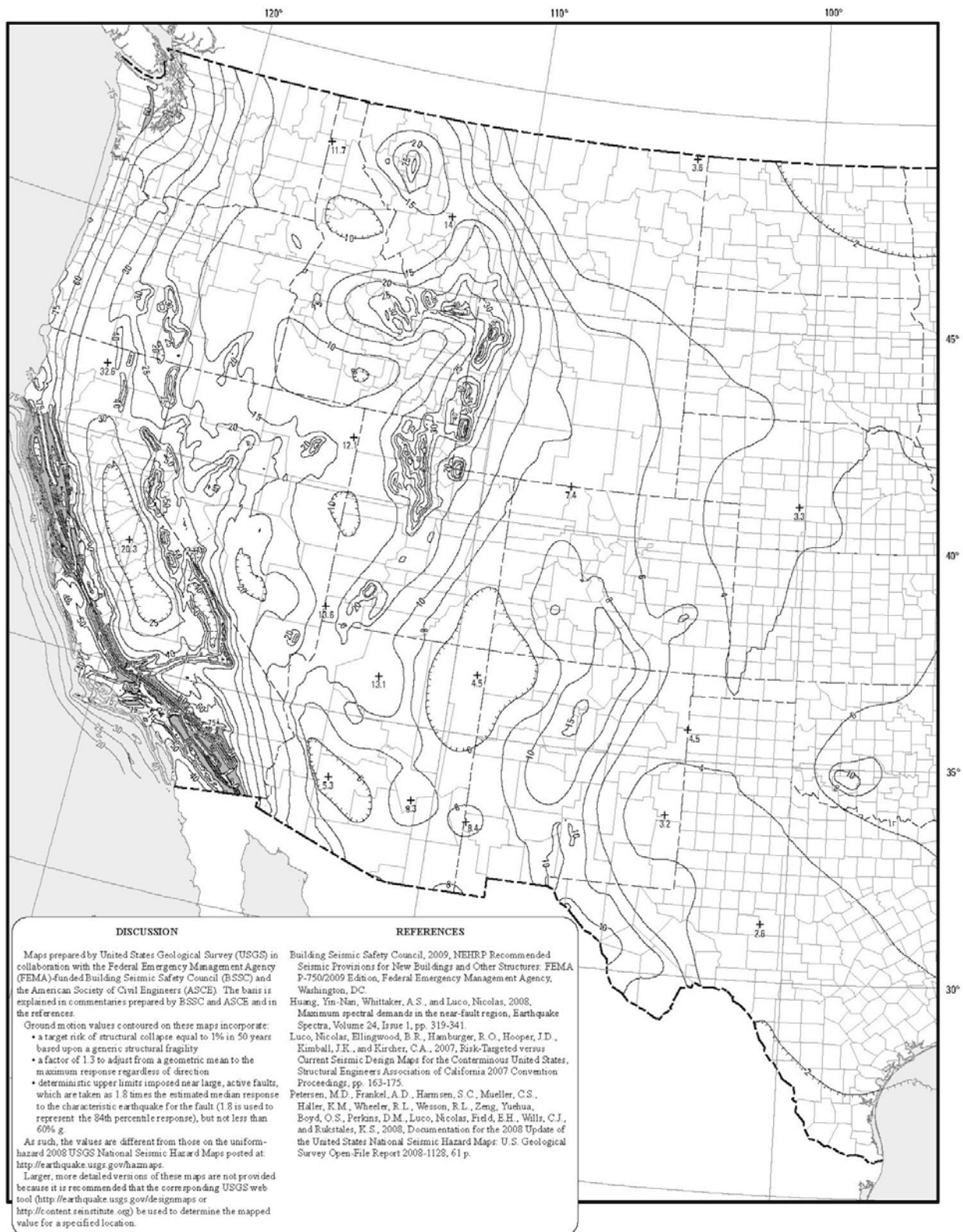
VALUE OF $S_{D1}$	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D



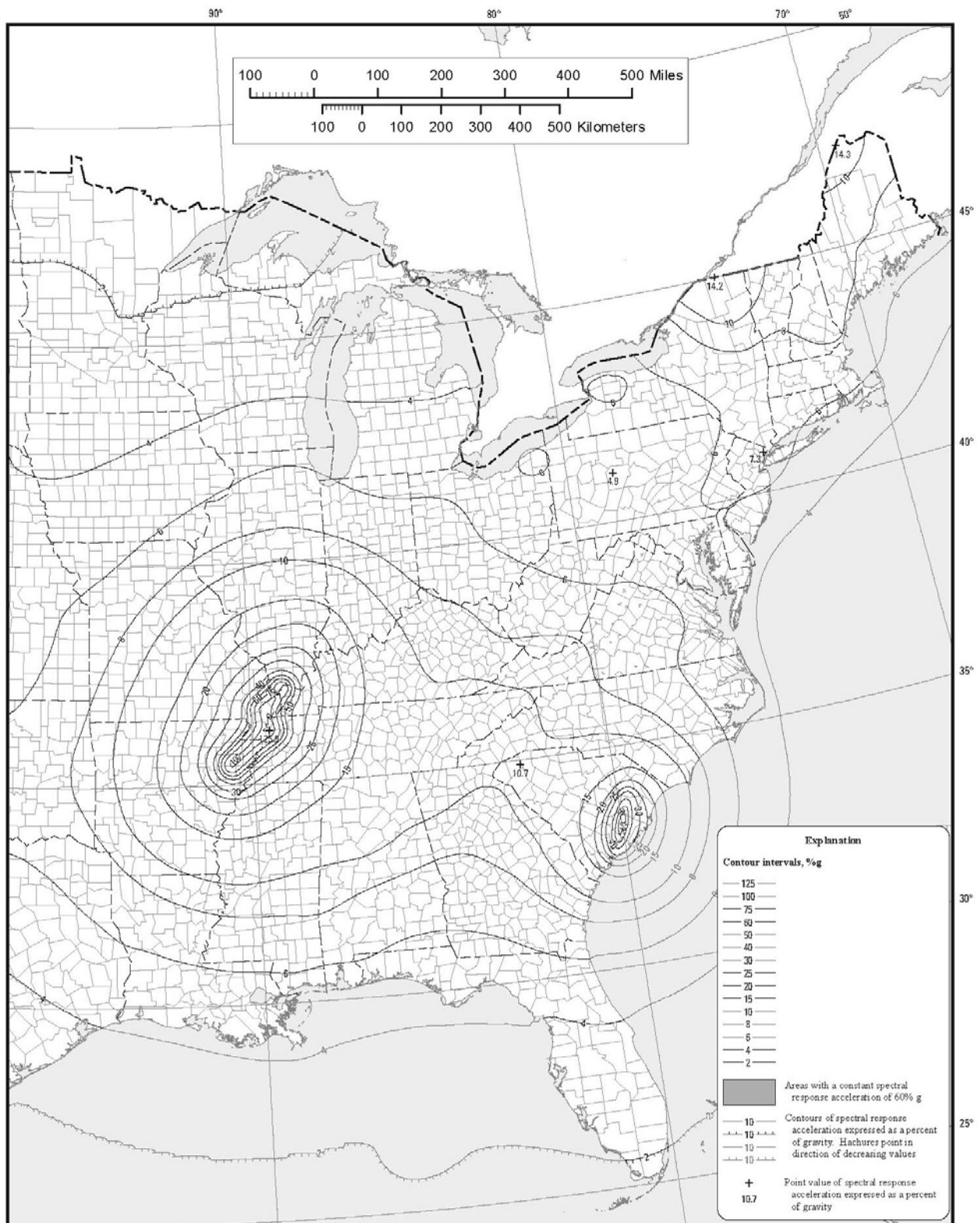


**FIGURE 1613.3.1(1)—continued**  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE ( $MCE_R$ ) GROUND MOTION RESPONSE ACCELERATIONS**  
**FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION**  
**(5% OF CRITICAL DAMPING), SITE CLASS B**

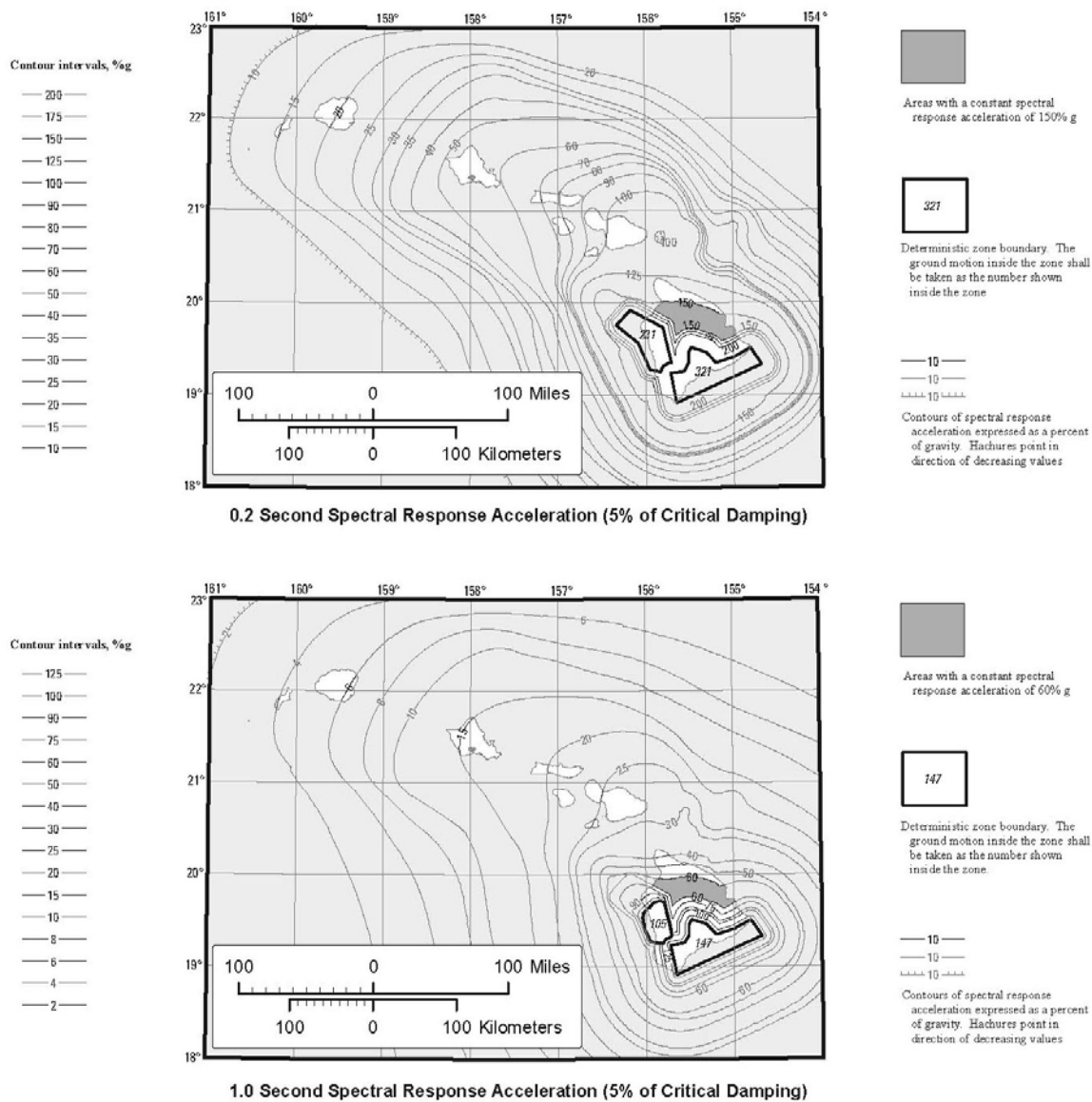




**FIGURE 1613.3.1(2)**  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE ( $MCE_R$ ) GROUND MOTION RESPONSE ACCELERATIONS**  
**FOR THE CONTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE ACCELERATION**  
**(5% OF CRITICAL DAMPING), SITE CLASS B**  
*(continued)*



**FIGURE 1613.3.1(2)—continued**  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE ( $MCE_R$ ) GROUND MOTION RESPONSE ACCELERATIONS**  
**FOR THE CONTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE ACCELERATION**  
**(5% OF CRITICAL DAMPING), SITE CLASS B**



**DISCUSSION**

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)/funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% and 60% g for 0.2 and 1.0 sec, respectively.

As such, the values are different from those on the uniform-hazard 1998 USGS National Seismic Hazard Maps for Hawaii posted at <http://earthquake.usgs.gov/hazmaps>.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (<http://earthquake.usgs.gov/designmaps>) or <http://content.sintstitute.org> be used to determine the mapped value for a specified location.

**REFERENCES**

Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures, FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.

Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, *Earthquake Spectra*, Volume 24, Issue 1, pp. 319-341.

Klein, F., Frankel, A.D., Mueller, C.S., Wesson, R.L., and Okubo, P., 2001, Seismic hazard in Hawaii: high rate of large earthquakes and probabilistic ground-motion maps, *Bulletin of the Seismological Society of America*, Volume 91, pp. 479-498.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, *Structural Engineers Association of California 2007 Convention Proceedings*, pp. 163-175.

**FIGURE 1613.3.1(3)**  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE<sub>R</sub>) GROUND MOTION RESPONSE ACCELERATIONS**  
**FOR HAWAII OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION**  
**(5% OF CRITICAL DAMPING), SITE CLASS B**

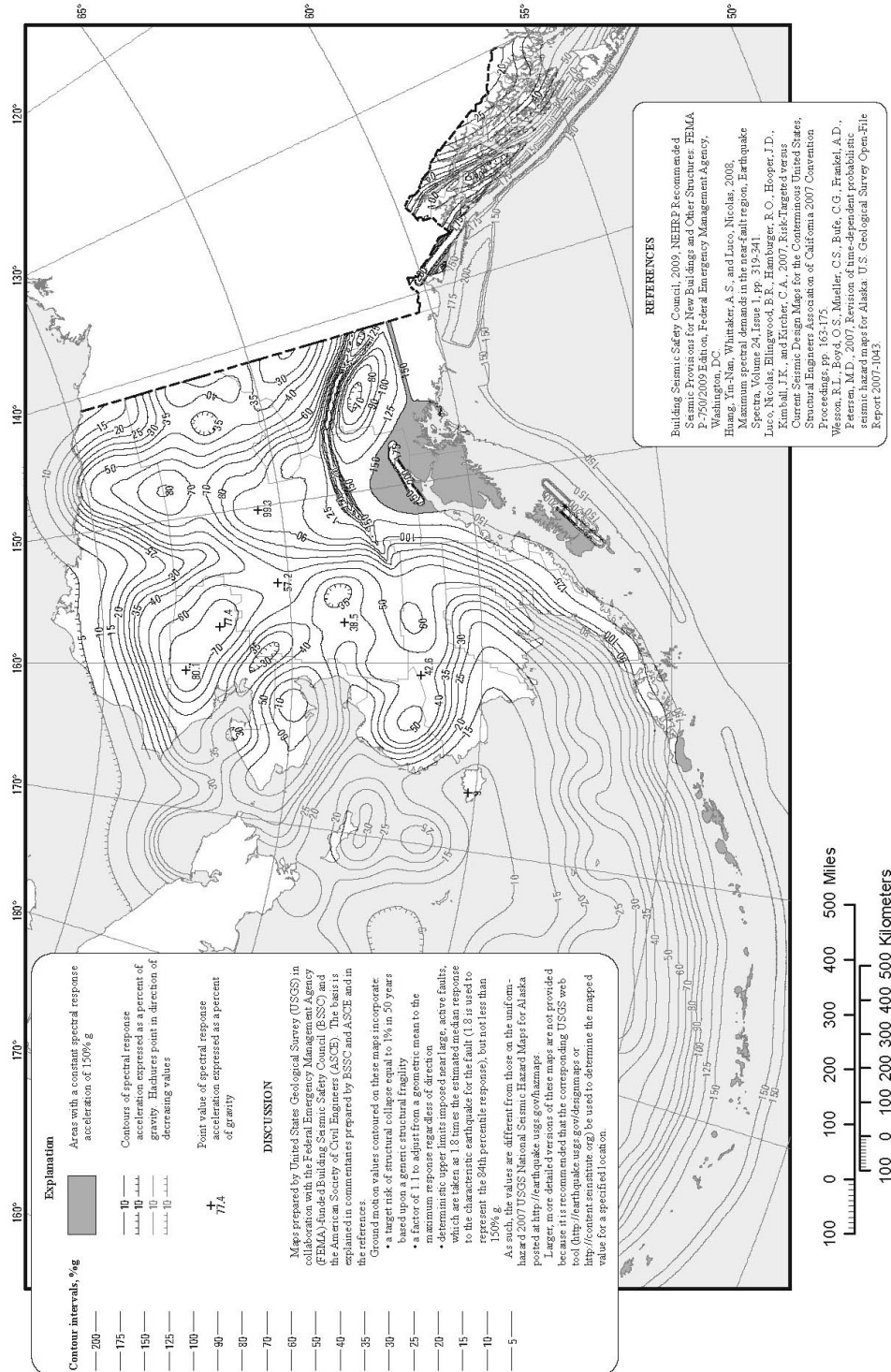
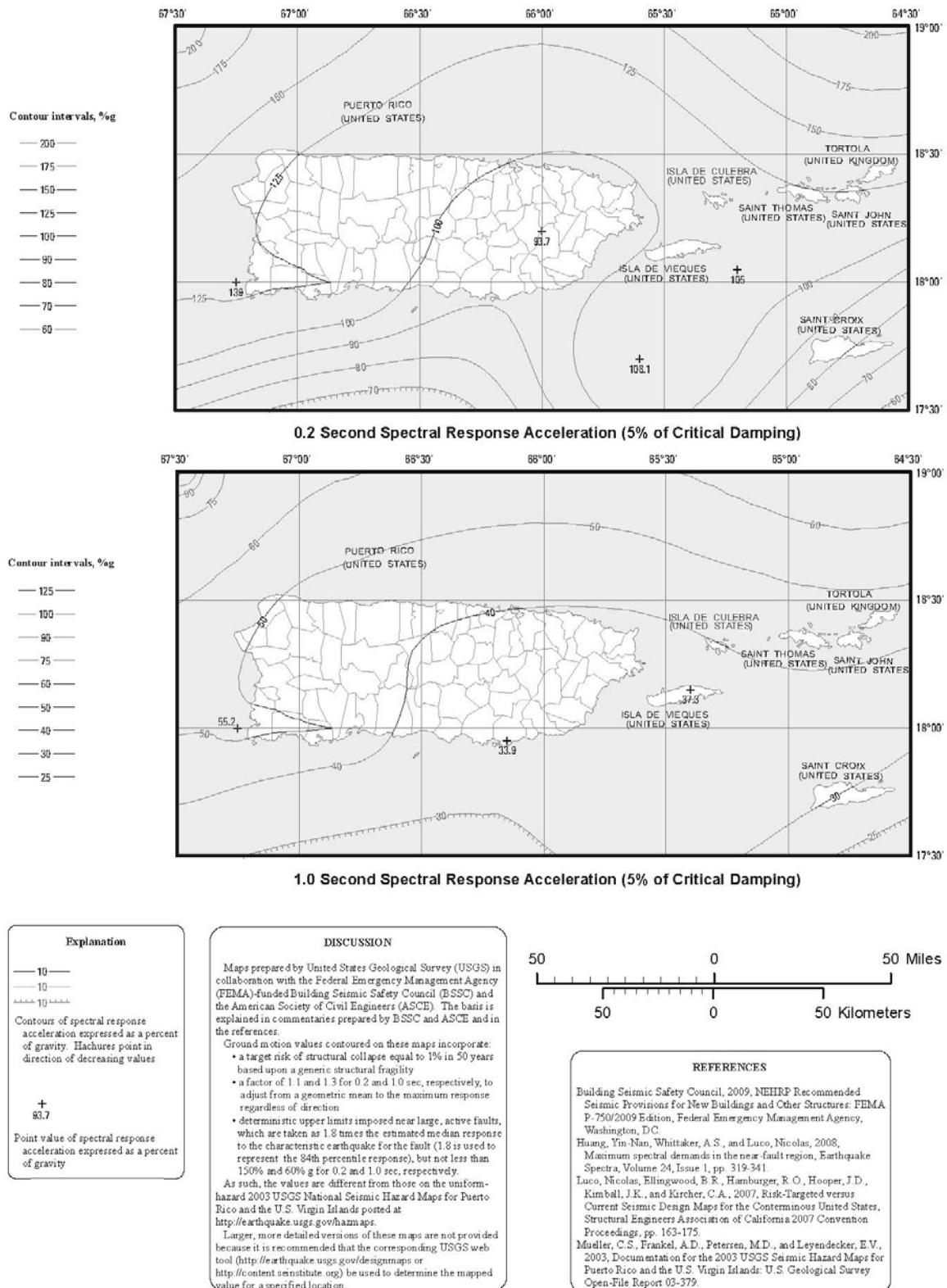


FIGURE 1613.3.1(4)  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE<sub>R</sub>) GROUND MOTION RESPONSE ACCELERATIONS  
 FOR ALASKA OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION  
 (5% OF CRITICAL DAMPING), SITE CLASS B**





**FIGURE 1613.3.1(6)**  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE ( $MCE_E$ ) GROUND MOTION RESPONSE ACCELERATIONS**  
**FOR PUERTO RICO AND THE UNITED STATES VIRGIN ISLANDS OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5%**  
**OF CRITICAL DAMPING), SITE CLASS B**

### 1613.3.5 Determination of seismic design category.

Structures classified as Risk Category I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period,  $S_1$ , is greater than or equal to 0.75 shall be assigned to Seismic Design Category E. Structures classified as Risk Category IV that are located where the mapped spectral response acceleration parameter at 1-second period,  $S_1$ , is greater than or equal to 0.75 shall be assigned to Seismic Design Category F. All other structures shall be assigned to a seismic design category based on their risk category and the design spectral response acceleration parameters,  $S_{DS}$  and  $S_{D1}$ , determined in accordance with Section 1613.3.4 or the site-specific procedures of ASCE 7. Each building and structure shall be assigned to the more severe seismic design category in accordance with Table 1613.3.5(1) or 1613.3.5(2), irrespective of the fundamental period of vibration of the structure,  $T$ .

**Exception:** [OSHPD 2] Structures not assigned to Seismic Design Category E or F above shall be assigned to Seismic Design Category D.

**1613.3.5.1 Alternative seismic design category determination.** Where  $S_1$  is less than 0.75, the seismic design category is permitted to be determined from Table 1613.3.5(1) alone when all of the following apply:

1. In each of the two orthogonal directions, the approximate fundamental period of the structure,  $T_a$ , in each of the two orthogonal directions determined in accordance with Section 12.8.2.1 of ASCE 7, is less than  $0.8 T_s$  determined in accordance with Section 11.4.5 of ASCE 7.
2. In each of the two orthogonal directions, the fundamental period of the structure used to calculate the story drift is less than  $T_s$ .
3. Equation 12.8-2 of ASCE 7 is used to determine the seismic response coefficient,  $C_s$ .
4. The diaphragms are rigid as defined in Section 12.3.1 of ASCE 7 or, for diaphragms that are flexible, the distances between vertical elements of the seismic force-resisting system do not exceed 40 feet (12 192 mm).

**Exception:** [OSHPD 2] Seismic design category shall be determined in accordance with exception to Section 1613.3.5.

**1613.3.5.2 Simplified design procedure.** Where the alternate simplified design procedure of ASCE 7 is used, the seismic design category shall be determined in accordance with ASCE 7.

**Exception:** [OSHPD 2] Seismic design category shall be determined in accordance with exception to Section 1613.3.5.

**1613.4 Alternatives to ASCE 7.** The provisions of Section 1613.4 shall be permitted as alternatives to the relevant provisions of ASCE 7.

**1613.4.1 Additional seismic force-resisting systems for seismically isolated structures.** Add the following exception to the end of Section 17.5.4.2 of ASCE 7:

**Exception:** For isolated structures designed in accordance with this standard, the Structural System Limitations and the Building Height Limitations in Table 12.2-1 for ordinary steel concentrically braced frames (OCBFs) as defined in Chapter 11 and ordinary moment frames (OMFs) as defined in Chapter 11 are permitted to be taken as 160 feet (48 768 mm) for structures assigned to Seismic Design Category D, E or F, provided that the following conditions are satisfied:

1. The value of  $R_t$  as defined in Chapter 17 is taken as 1.
2. For OMFs and OCBFs, design is in accordance with AISC 341.

**1613.5 [BSC, HCD 1 & HCD 2] Modifications to ASCE 7.** The text of ASCE 7 shall be modified as indicated in Sections 1613.5.1 through 1613.5.2.

**1613.5.1 [BSC, HCD 1 & HCD 2] Modify ASCE 7 DEFINITIONS** as follows:

#### 1.2 DEFINITIONS.

**BALLASTED PHOTOVOLTAIC SYSTEM:** A roof mounted system composed of solar photovoltaic panels and supporting members that are unattached or partially attached to the roof and must rely on its weight, aerodynamics and friction to counter the effect of wind and seismic forces.

**1613.5.2 [BSC, HCD 1 & HCD 2] Modify ASCE 7 Section 13.4** as follows:

#### Section 13.4 NONSTRUCTURAL COMPONENT ANCHORAGE.

Components and their supports shall be attached (or anchored) to the structure in accordance with the requirements of this section and the attachment shall satisfy the requirements for the parent material as set forth elsewhere in this standard. Component attachments shall be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity. A continuous load path of sufficient strength and stiffness between the component and the supporting structure shall be provided. Local elements of the structure including connections shall be designed and constructed for the component forces where they control the design of the elements or their connections. The component forces shall be those determined in Section 13.3.1, except that modifications to  $F_p$  and  $R$ , due to anchorage conditions need not be considered. The design documents shall include sufficient information relating to the attachments to verify compliance with the requirements of this section.

**Exception:** Ballasted photovoltaic systems when design is based on Section 13.4.7 and approved by the enforcing agency.



**13.4.7. Solar PV panels or modules installed on a roof as a ballasted system need not be rigidly attached to the roof or supporting structure. Ballasted systems shall be designed and installed only on roofs with slopes 1 inch per foot or less. The ballasted system shall be designed to resist sliding and uplift resulting from lateral and vertical forces, using a coefficient of friction determined by acceptable engineering practices. In sites where the Seismic Design Category is C or above, the system shall be designed to accommodate seismic displacement determined by approved analysis or shake-table testing, using input motions consistent with ASCE 7 lateral and vertical seismic forces for non-structural components on roofs.**

## SECTION 1614 ATMOSPHERIC ICE LOADS

**1614.1 General.** Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

## SECTION 1615 STRUCTURAL INTEGRITY

**1615.1 General.** High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of this section. Frame structures shall comply with the requirements of Section 1615.3. Bearing wall structures shall comply with the requirements of Section 1615.4.

**1615.2 Definitions.** The following words and terms are defined in Chapter 2:

### BEARING WALL STRUCTURE.

### FRAME STRUCTURE.

**1615.3 Frame structures.** Frame structures shall comply with the requirements of this section.

**1615.3.1 Concrete frame structures.** Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of ACI 318 Sections 7.13, 13.3.8.5, 13.3.8.6, 16.5, 18.12.6, 18.12.7 and 18.12.8 as applicable. Where ACI 318 requires that non-prestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

**Exception:** Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal

reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

**1615.3.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures.** Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

**1615.3.2.1 Columns.** Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

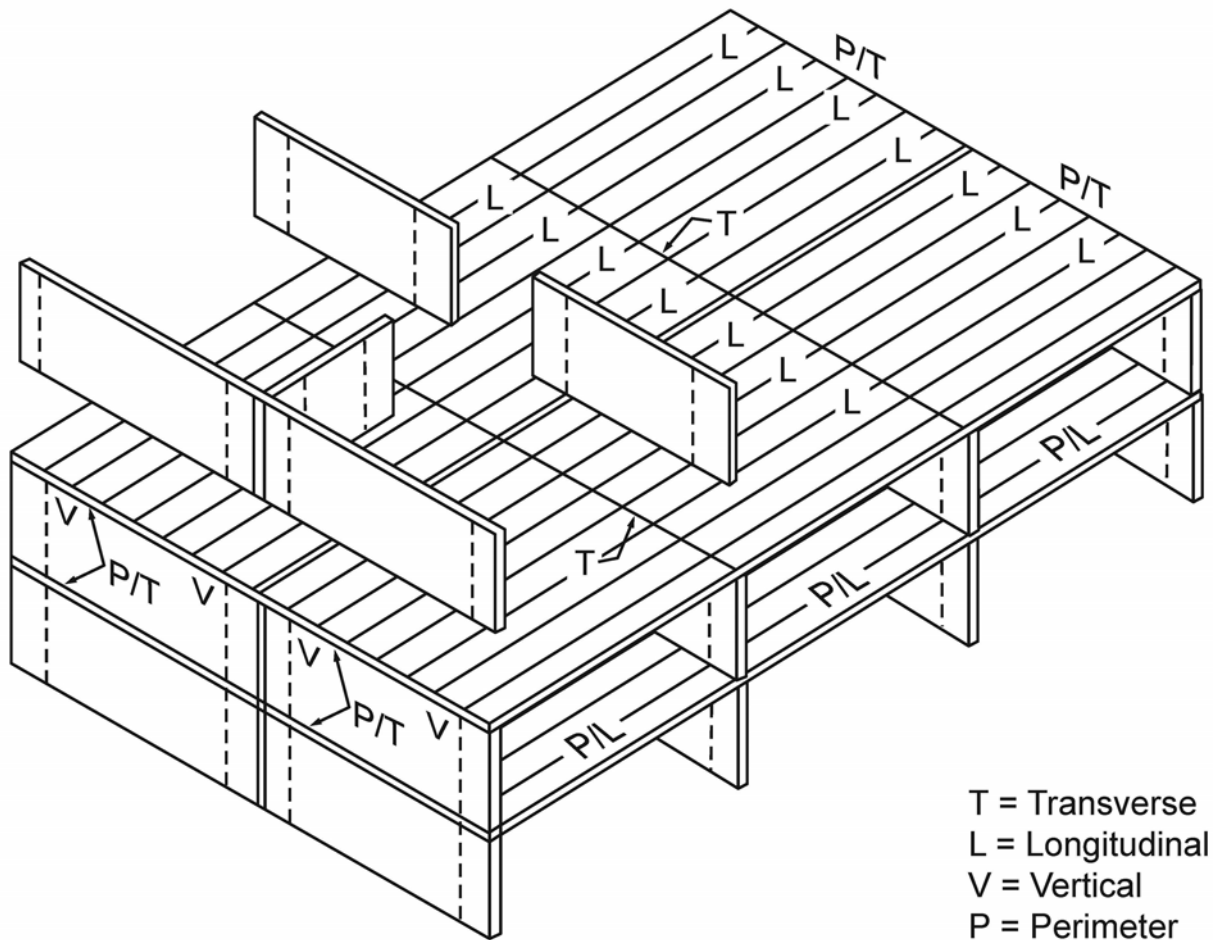
**1615.3.2.2 Beams.** End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

**Exception:** Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than  $\frac{3}{8}$ -inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

**1615.4 Bearing wall structures.** Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1615.4.

**1615.4.1 Concrete wall structures.** Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 7.13, 13.3.8.5 and 16.5 of ACI 318.





**FIGURE 1615.4**  
**LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES**

**1615.4.2 Other bearing wall structures.** Ties in bearing wall structures other than those covered in Section 1615.4.1 shall conform to this section.

**1615.4.2.1 Longitudinal ties.** Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength,  $T_T$ , given by Equation 16-41. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_T = w LS \leq \alpha_T S \quad \text{(Equation 16-41)}$$

where:

$L$  = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

$w$  = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m<sup>2</sup>).

$S$  = The spacing between ties, feet (m).

$\alpha_T$  = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

**1615.4.2.2 Transverse ties.** Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed no farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength  $T_T$ , given by Equation 16-46. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

**1615.4.2.3 Perimeter ties.** Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than  $T_p$ , given by Equation 16-42. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_p = 200w \leq \beta_T \quad \text{(Equation 16-42)}$$

For SI:  $T_p = 90.7w \leq \beta_T$

where:

$w$  = As defined in Section 1615.4.2.1.

$\beta_T$  = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame construction.

**1615.4.2.4 Vertical ties.** Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. No fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

## SECTION 1616

### ADDITIONAL REQUIREMENTS [DSA-SS/CC]

#### 1616.1 Construction documents.

**1616.1.1 Additional requirements for construction documents** are included in Sections 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R.).

**1616.1.2 Connections.** Connections that resist design seismic forces shall be designed and detailed on the design drawings.

**1616.1.3 Construction procedures.** Where unusual erection or construction procedures are considered essential by the project structural engineer or architect in order to accomplish the intent of the design or influence the design, such procedure shall be indicated on the plans or in the specifications.

#### 1616.2 General design requirements.

##### 1616.2.1 Lateral load deflections.

**1616.2.1.1 Horizontal diaphragms.** The maximum span-width ratio for any roof or floor diaphragm shall not exceed those given in Table 4.2.4 of AF & PA < SDPWS for wood sheathed diaphragms. For other diaphragms, test data and design calculations acceptable to the enforcement agency shall be submitted and approved for span-width ratios.

**1616.2.1.2 Veneers.** The deflection shall not exceed  $l/600$  for veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing.

**1616.2.1.3 Risk Category of buildings and other structures.** Risk Category IV includes structures as defined in the California Administrative Code, Section 4-207 and all structures required for their continuous operation or access/egress.

**1616.2.2 Structural walls.** For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-

plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.

### 1616.3 Load combinations.

**1616.3.1 Stability.** When checking stability under the provisions of Section 1605.1.1 using allowable stress design, the factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported.

**1616.4 Roof dead loads.** The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1510.

### 1616.5 Live loads.

#### 1616.5.1 Modifications to Table 1607.1.

**1616.5.1.1 Item 4. Assembly areas.** The following minimum loads for stage accessories apply:

1. Gridirons and fly galleries: 75 pounds per square foot uniform live load.
2. Loft block wells: 250 pounds per lineal foot vertical load and lateral load.
3. Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads. Sheave blocks shall be designed with a safety factor of five.
4. Scenery beams where there is no gridiron: 300 pounds per lineal foot vertical load and lateral load.
5. Ceiling framing over stages shall be designed for a uniform live load of 20 pounds per square foot. For members supporting a tributary area of 200 square feet or more, this additional load may be reduced to 15 pounds per square foot (0.72 kN/m<sup>2</sup>).

**1616.5.1.2 Item 24. Reviewing stands, grandstands and bleachers.** The minimum uniform live load for a press box floor or accessible roof with railing is 100 psf.

**1616.5.1.3 Item 35. Yards and terraces, pedestrians.** Item 35 applies to pedestrian bridges and walkways that are not subjected to uncontrolled vehicle access.

**1616.5.1.4 Item 36. Storage racks and wall-hung cabinets.** The minimum vertical design live load shall be as follows:

Paper media:

12-inch-deep (305 mm) shelf - 33 pounds per lineal foot (482 N/m)

15-inch-deep (381 mm) shelf - 41 pounds per lineal foot (598 N/m), or 33 pounds per cubic foot (5183 N/m<sup>3</sup>) per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep (457 mm) shelf - 100 pounds per lineal foot (1459 N/m), or

50 pounds per cubic foot (7853 N/m<sup>3</sup>) per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot (311 N/m<sup>3</sup>) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

**1616.5.2 Uncovered open-frame roof structures.** Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m<sup>2</sup>) of the total area encompassed by the framework.

**1616.6 Determination of snow loads.** The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA.

### 1616.7 Wind loads.

**1616.7.1 Story drift for wind loads.** The calculated story drift due to wind pressures with ultimate design wind speed,  $V_{ult}$ , shall not exceed 0.008 times the story height for buildings less than 65 feet (19,812 mm) in height or 0.007 times the story height for buildings 65 feet (19,812 mm) or greater in height.

**Exception:** This story drift limit need not be applied for single-story open structures.

**1616.8 Establishment of flood hazard areas.** Flood hazard maps shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located, as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto.

### 1616.9 Earthquake loads.

**1616.9.1 Seismic design category.** The seismic design category for a structure shall be determined in accordance with Section 1613.

**1616.9.2 Definitions.** In addition to the definitions in Section 1613.2, the following words and terms shall, for the purposes of this section, have the meanings shown herein.

**ACTIVE EARTHQUAKE FAULT.** A fault that has been the source of earthquakes or is recognized as a potential source of earthquakes, including those that have exhibited surface displacement within Holocene time (about 11,000 years) as determined by California Geological Survey (CGS) under the Alquist-Priolo Earthquake Fault Zoning Act, those included as type A or type B faults for the U.S. Geological Survey (USGS) National Seismic Hazard Maps, and faults considered to have been active in Holocene time by an authoritative source, federal, state or local governmental agency.

**BASE.** The level at which the horizontal seismic ground motions are considered to be imparted to the structure or the level at which the structure as a dynamic vibrator is supported. This level does not necessarily coincide with the ground level.

**DISTANCE FROM AN ACTIVE EARTHQUAKE FAULT.** Distance measured from the nearest point of the building to the closest edge of an Alquist-Priolo Earthquake fault zone for an active fault, if such a map exists, or to the closest mapped splay of the fault.

**IRREGULAR STRUCTURE.** A structure designed as having one or more plan or vertical irregularities per ASCE 7 Section 12.3.

**STRUCTURAL ELEMENTS.** Floor or roof diaphragms, decking, joists, slabs, beams, or girders, columns, bearing walls, retaining walls, masonry or concrete nonbearing walls exceeding one story in height, foundations, shear walls or other lateral-force-resisting members, and any other elements necessary to the vertical and lateral strength or stability of either the building as a whole or any of its parts, including connection between such elements.

**1616.9.3 Mapped acceleration parameters.** Seismic Design Category shall be determined in accordance with Section 1613.3.5.

**1616.9.4 Determination of seismic design category.** Structures not assigned to Seismic Design Category E or F, in accordance with Section 1613.3, shall be assigned to Seismic Design Category D.

**1616.9.4.1 Alternative seismic design category determination.** The alternative Seismic Design Category determination procedure of Section 1613.3.5.1 is not permitted by DSA-SS/CC.

**1616.9.4.2 Simplified design procedure.** The simplified design procedure of Section 1613.3.5.2 is not permitted by DSA-SS/CC.

**1616.9.5 Automatic sprinkler systems.** The allowable values for design of anchors, hangers, and bracing elements shall be determined in accordance with material chapters of this code in lieu of those in NFPA 13.

**1616.10 Modifications to ASCE 7.** The text of ASCE 7 shall be modified as indicated in Sections 1616.10.1 through 1616.10.24.

**1616.10.1 ASCE 7, Section 1.3.** Modify ASCE 7 Section 1.3 by adding Section 1.3.6 as follows:

**1.3.6 Structural design criteria.** Where design is based on ASCE 7 Chapters 16, 17, 18, or 31, the ground motion, wind tunnel design recommendations, analysis, and design methods, material assumptions, testing requirements, and acceptance criteria proposed by the engineer shall be submitted to the enforcement agency in the form of structural design criteria for approval.

Peer review requirements in Section 3422 of this code shall apply to design reviews required by ASCE 7 Chapters 17 and 18.

**1616.10.2 ASCE 7, Section 11.4.7.** Modify ASCE 7 Section 11.4.7 by adding the following:

For buildings assigned to Seismic Design Category E and F, or when required by the building official, a ground motion hazard analysis shall be performed in accordance with ASCE 7 Chapter 21, as modified by Section 1803A.6 of this code.

**1616.10.3 ASCE 7, Table 12.2-1.** Modify ASCE 7 Table 12.2-1 as follows:

#### A. BEARING WALL SYSTEMS

17. Light-framed walls with shear panels of all other materials - Not permitted by DSA-SS/CC.

#### B. BUILDING FRAME SYSTEMS

24. Light-framed walls with shear panels of all other materials - Not permitted by DSA-SS/CC.

#### C. MOMENT RESISTING FRAME SYSTEMS

12. Cold-formed steel — special bolted moment frame - Not permitted by DSA-SS/CC.

##### Exception:

- 1) Systems listed in this section can be used as an alternative system when pre-approved by the enforcement agency.
- 2) Rooftop or other supported structures not exceeding two stories in height and 10 percent of the total structure weight can use the systems in this section when designed as components per ASCE 7 Chapter 13.
- 3) Systems listed in this section can be used for seismically isolated buildings when permitted by Section 1613.4.1.

**1616.10.4 ASCE 7, Section 12.2.3.1.** Replace ASCE 7 Section 12.2.3.1, Items 1 and 2 by the following:

The value of the response modification coefficient,  $R$ , used for design at any story shall not exceed the lowest value of  $R$  that is used in the same direction at any story above that story. Likewise, the deflection amplification factor,  $C_d$ , and the system over strength factor,  $\Omega_0$ , used for the design at any story shall not be less than the largest value of these factors that are used in the same direction at any story above that story.

**1616.10.5 ASCE 7, Section 12.2.3.2.** Modify ASCE 7 Section 12.2.3.2 by adding the following additional requirements for a two stage equivalent lateral force procedure or modal response spectrum procedure:

f. Where design of elements of the upper portion is governed by special seismic load combinations, the special loads shall be considered in the design of the lower portions.

**1616.10.6 ASCE 7, Section 12.2.5.6.1.** The exception in Item a is not permitted by DSA-SS/CC.

**1616.10.7 ASCE 7, Section 12.2.5.7.1.** The exception in Item a is not permitted by DSA-SS/CC.

**1616.10.8 ASCE 7, Section 12.2.5.7.2.** The exception in Item a is not permitted by DSA-SS/CC.

**1616.10.9 ASCE 7, Section 12.3.3.1.** Modify ASCE 7 Section 12.3.3.1 as follows:

**12.3.3.1 Prohibited horizontal and vertical irregularities for Seismic Design Categories D through F.** Structures assigned to Seismic Design Category E or F having horizontal structural irregularity Type 1b of Table 12.3-1 or vertical structural irregularities Type 1b, 5a or 5b of Table 12.3-2 shall not be permitted. Structures assigned to Seismic Design Category D having vertical irregularity Type 1b or 5b of Table 12.3-2 shall not be permitted.

**1616.10.10 ASCE 7, Section 12.7.2.** Modify ASCE 7 Section 12.7.2 by adding Item 6 to read as follows:

6. Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a Geotechnical engineer qualified in soils engineering, plus the difference in earth pressures shall be added to the lateral forces provided in this section.

**1616.10.11 ASCE 7, Section 12.8.1.3.** Replace ASCE 7 Section 12.8.1.3 by the following:

**12.8.1.3 Maximum  $S_s$  value in determination of  $C_s$ .** For regular structures five stories or less above the base, as defined in Section 11.2 and with a period,  $T$ , of 0.5 s or less,  $C_s$  is permitted to be calculated using the larger of either  $S_s = 1.5$  or 80 percent of the value of  $S_s$  determined per Section 11.4.1 or 11.4.7.

**1616.10.12 ASCE 7, Section 12.9.4.** Replace ASCE 7 Section 12.9.4 as follows:

**12.9.4 Scaling design values of combined response.** Modal base shears used to determine forces and drifts shall not be less than the base shear calculated using the equivalent lateral force procedure of Section 12.8.

**1616.10.13 ASCE 7, Section 12.10.2.1.** Replace ASCE 7 Exception 1 of Section 12.10.2.1 by the following:

**Exception:** The forces calculated above need not exceed those calculated using the load combinations of Section 12.4.3.2 with seismic forces determined by Equation 12.10-3 and transfer forces, where applicable.

**1616.10.14 ASCE 7, Section 12.13.1.** Modify ASCE 7 Section 12.13.1 by adding Section 12.13.1.1 as follows:

**12.13.1.1 Foundations and superstructure-to-foundation connections.** The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605.1.1.

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. The strength of the superstructure elements
2. The maximum forces that would occur in the fully yielded structural system
3. Forces from the Load Combinations with over-strength factor in accordance with ASCE 7 Section 12.4.3.2

**Exceptions:**

1. Where referenced standards specify the use of higher design loads.
2. When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.
3. Where basic structural system consists of light-framed walls with shear panels, unless the reference standard specifies the use of higher design loads.

Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the modal analysis method, reduction in overturning moment permitted by Section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

**1616.10.15 ASCE 7, Section 13.1.4.** Replace ASCE 7 Section 13.1.4 by the following:

**13.1.4 Exemptions.** The following nonstructural components are exempt from the requirements of this section:

1. Furniture (except storage cabinets as noted in Table 13.5-1).
2. Temporary or moveable (mobile) equipment.

**Exceptions:**

- 1) Equipment shall be anchored if it is permanently attached to the building utility services such as electricity, gas, or water. For the purposes of this requirement, "permanently attached" shall include all electrical connections except plugs for duplex receptacles.
- 2) The enforcement agency shall be permitted to require temporary attachments for movable equipment which is usually stationed in one place and heavier than 400 pounds, when they are not in use for a period longer than 8 hours at a time.

3. *Mechanical and electrical components in Seismic Design Categories D, E or F where all of the following apply:*

- a. *The component is positively attached to the structure;*
- b. *Flexible connections are provided at seismic separation joints and between the component and associated ductwork, piping and conduit; and either:*
  - i. *The component weighs 400 lb (1780 N) or less and has a center of mass located 4 ft. (1.22 m) or less above the adjacent floor or roof level;*

**Exception:** *Special Seismic Certification requirements of this code in accordance with Section 1705A.12.3 shall be applicable.*

or

- ii. *The component weighs 20 lb (89 N) or less or, in the case of a distributed system, 5 lb/ft (73 N/m) or less.*

**Exception:** *The enforcement agency shall be permitted to require attachments for equipment with hazardous contents to be shown on construction documents irrespective of weight.*

**1616.10.16 ASCE 7, Section 13.5.6.** *Replace ASCE 7, Section 13.5.6 by the following:*

**13.5.6 Suspended ceilings.** *Suspended ceilings shall be in accordance with this section.*

**13.5.6.1 Seismic forces.** *The weight of the ceiling,  $W_p$ , shall include the ceiling grid; ceiling tiles or panels; light fixtures if attached to, clipped to, or laterally supported by the ceiling grid; and other components that are laterally supported by the ceiling.  $W_p$  shall be taken as not less than 4 psf (19 N/m<sup>2</sup>).*

*The seismic force,  $F_p$ , shall be transmitted through the ceiling attachments to the building structural elements or the ceiling-structure boundary.*

**13.5.6.2 Industry standard construction for acoustical tile or lay-in panel ceilings.** *Unless designed in accordance with ASTM E 580 Section 5.2.8, or seismically qualified in accordance with Sections 13.2.5 or 13.2.6, acoustical tile or lay-in panel ceilings shall be designed and constructed in accordance with this section.*

**13.5.6.2.1 Seismic Design Categories D through F.** *Acoustical tile or lay-in panel ceilings in Seismic Design Categories D, E and F shall be designed and installed in accordance with ASTM C 635, ASTM C 636, and ASTM E 580, Section 5 - Seismic Design Categories D, E and F as modified by this section.*

**13.5.6.2.2 Modification to ASTM E 580.** *Modify ASTM E 580 by the following:*

1. **Exitways.** *Lay-in ceiling assemblies in exitways of hospitals and essential services buildings shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors.*
2. **Corridors and lobbies.** *Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.*
3. **Lay-in panels.** *Metal panels and panels weighing more than  $\frac{1}{2}$  pounds per square foot (24 N/m<sup>2</sup>) other than acoustical tiles shall be positively attached to the ceiling suspension runners.*
4. **Lateral force bracing.** *Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E 580 Sections 5.2.2 and 5.2.3 are provided and perimeter walls are designed to carry the ceiling lateral forces. Restraint wires shall be secured with four tight twists in  $1\frac{1}{2}$  inches, or an approved alternate connection.*
5. **Ceiling fixtures.** *Fixtures installed in acoustical tile or lay-in panel ceilings shall be mounted in a manner that will not compromise ceiling performance.*

*All recessed or drop-in light fixtures and grilles shall be supported directly from the fixture housing to the structure above with a minimum of two 12-gage wires located at diagonally opposite corners. Leveling and positioning of fixtures may be provided by the ceiling grid. Fixture support wires may be slightly loose to allow the fixture to seat in the grid system. Fixtures shall not be supported from main runners or cross runners if the weight of the fixtures causes the total dead load to exceed the deflection capability of the ceiling suspension system.*

*Fixtures shall not be installed so that the main runners or cross runners will be eccentrically loaded.*

*Surface-mounted fixtures shall be attached to the main runner with at least two positive clamping devices made of material with a minimum of 14 gage. Rotational spring catches do not com-*

ply. A 12-gage suspension wire shall be attached to each clamping device and to the structure above.

6. **Partitions.** Where the suspended ceiling system is required to provide lateral support for the permanent or relocatable partitions, the connection of the partition to the ceiling system, the ceiling system members and their connections, and the lateral force bracing shall be designed to support the reaction force of the partition from prescribed loads applied perpendicular to the face of the partition. Partition connectors, the suspended ceiling system and the lateral-force bracing shall all be engineered to suit the individual partition application and shall be shown or defined in the drawings or specifications.

**1616.10.17 ASCE 7, Section 13.6.5.** Modify ASCE 7, Section 13.6.5.6, Exceptions 1 and 2, as follows:

**Exceptions:**

1. Design for the seismic forces of Section 13.3 shall not be required for raceways where either:
  - a. Trapeze assemblies are used to support raceways and the total weight of the raceway supported by trapeze assemblies is less than 10 lb/ft (146 N/m), or
  - b. The raceway is supported by hangers and each hanger in the raceway run is 12 in. (305 mm) or less in length from the raceway support point to the supporting structure. Where rod hangers are used, they shall be equipped with swivels to prevent inelastic bending in the rod.
2. Design for the seismic forces of Section 13.3 shall not be required for conduit, regardless of the value of  $I_p$ , where the conduit is less than 2.5 in. (64 mm) trade size.

**1616.10.18 ASCE 7, Section 13.6.7.** Replace ASCE 7, Section 13.6.7, Exceptions 1 and 2, by the following:

**Exceptions:**

The following exceptions pertain to ductwork not designed to carry toxic, highly toxic or flammable gases, or used for smoke control:

1. Design for the seismic forces of Section 13.3 shall not be required for ductwork where either:
  - a. Trapeze assemblies are used to support ductwork and the total weight of the ductwork supported by trapeze assemblies is less than 10 lb/ft (146 N/m); or
  - b. The ductwork is supported by hangers and each hanger in the duct run is 12 in. (305 mm) or less in length from the duct support point to the supporting structure. Where rod hangers are used, they shall be equipped with swivels to prevent inelastic bending in the rod.

2. Design for the seismic forces of Section 13.3 shall not be required where provisions are made to avoid impact with larger ducts or mechanical components or to protect the ducts in the event of such impact; and HVAC ducts have a cross-sectional area of 6 ft<sup>2</sup> (0.557 m<sup>2</sup>) or less, or weigh 10 lb/ft (146 N/m) or less.

**1616.10.19 ASCE 7, Section 13.6.8.** Modify ASCE 7, Section 13.6.8.2 by adding exception as follows:

**Exception:** Anchor capacities shall be determined in accordance with material chapters of this code in lieu of using those in NFPA 13 and demand shall be based on ASCE 7.

**1616.10.20 ASCE 7, Section 13.6.8.3.** Replace ASCE 7, Section 13.6.8.3 with the following:

**13.6.8.3 Exceptions.** Design of piping systems and attachments for the seismic forces of Section 13.3 shall not be required where one of the following conditions apply:

1. Trapeze assemblies are used to support piping whereby no single pipe exceeds the limits set forth in 3a. or b. below and the total weight of the piping supported by the trapeze assemblies is less than 10 lb/ft (146 N/m).
2. The piping is supported by hangers and each hanger in the piping run is 12 in. (305 mm) or less in length from the top of the pipe to the supporting structure. Where pipes are supported on a trapeze, the trapeze shall be supported by hangers having a length of 12 in. (305 mm) or less. Where rod hangers are used, they shall be equipped with swivels, eye nuts or other devices to prevent bending in the rod.
3. Piping having an  $R_p$  in Table 13.6-1 of 4.5 or greater is used and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact and where the following size requirements are satisfied:
  - a. For Seismic Design Categories D, E or F and values of  $I_p$  greater than one, the nominal pipe size shall be 1 inch (25 mm) or less.
  - b. For Seismic Design Categories D, E or F where  $I_p = 1.0$  the nominal pipe size shall be 3 inches (80 mm) or less.

The exceptions above shall not apply to elevator piping.

**1616.10.21 ASCE 7, Section 13.6.10.1.** Modify ASCE 7 Section 13.6.10.1 by adding Section 13.6.10.1.1, as follows:

**13.6.10.1.1 Elevators guide rail support.** The design of guide rail support bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not more than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one-third to the top

guiding members and two-thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7 Section 13.6.10.1, the minimum seismic forces shall be 0.5g acting in any horizontal direction.

**1616.10.22 ASCE 7, Section 13.6.10.4.** Replace ASCE 7 Section 13.6.10.4, as follows:

**13.6.10.4 Retainer plates.** Retainer plates are required at the top and bottom of the car and counterweight, except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:

1. The seismic force shall be computed per the requirements of ASCE 7 Section 13.6.10.1. The minimum horizontal acceleration shall be 0.5g for all buildings.
2.  $W_p$  shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.
3. With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below:

**TABLE 1224.4.11  
ACCEPTABLE CEILING AND CARPET LOCATIONS**

RAIL SIZE (weight per foot of length, pounds)	WIDTH OF MACHINED SURFACE (inches)	ALLOWABLE RAIL DEFLECTION (inches)
8	$1\frac{1}{4}$	0.20
11	$1\frac{1}{2}$	0.30
12	$1\frac{3}{4}$	0.40
15	$1\frac{31}{32}$	0.50
$18\frac{1}{2}$	$1\frac{31}{32}$	0.50
$22\frac{1}{2}$	2	0.50
30	$2\frac{1}{4}$	0.50

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.

Note: Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.

4. Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.
5. The use of spreader brackets is allowed.
6. Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g.

**1616.10.23 ASCE 7, Section 16.1.4.** Remove ASCE 7 Sections 16.1.4.1 and 16.1.4.2 and modify 16.1.4 by the following:

Maximum scaled base shears used to determine forces and drifts shall not be less than the base shear calculated using the equivalent lateral force procedure of Section 12.8.

**1616.10.24 ASCE 7, Section 16.2.4.** Modify ASCE 7 Section 16.2.4 by the following:

- a) Where site is located within 3.1 miles (5 km) of an active fault at least seven ground motions shall be analyzed and response parameters shall be based on larger of the average of the maximum response with ground motions applied as follows:
  1. Each of the ground motions shall have their maximum component at the fundamental period aligned in one direction.
  2. Each of the ground motion's maximum component shall be rotated orthogonal to the previous analysis direction.
- b) Where site is located more than 3.1 miles (5 km) from an active fault at least 10 ground motions shall be analyzed. The ground motions shall be applied such that one-half shall have their maximum component aligned in one direction and the other half aligned in the orthogonal direction. The average of the maximum response of all the analyses shall be used for design.

**1616.10.25 ASCE 7, Section 17.2.1.** Modify ASCE 7 Section 17.2.1 by adding the following:

The importance factor,  $I_p$ , for parts and portions of a seismically isolated building shall be the same as that required for a fixed-base building of the same risk category.

**1616.10.26 ASCE 7 Section 17.2.4.7.** Modify ASCE 7 Section 17.2.4.7 by adding the following to the end of the section:

The effects of uplift and/or rocking shall be explicitly accounted for in the analysis and in the testing of the isolator units.

**1616.10.27 ASCE 7, Section 17.2.5.2.** Modify ASCE 7, Section 17.2.5.2 by adding the following:

The separation requirements for the building above the isolation system and adjacent buildings shall be the sum of the factored displacements for each building. The factors to be used in determining separations shall be:

1. For seismically isolated buildings, the deformation resulting from the analyses using the maximum considered earthquake unmodified by  $R_p$ .
2. For fixed based buildings,  $C_d$  times the elastic deformations resulting from an equivalent static analysis using the seismic base shear computed via ASCE 7 Section 12.8.





## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 16A – STRUCTURAL DESIGN

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>							X		X			X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>						X														
<i>Chapter / Section</i>																				
1607A.8.2						X														



## CHAPTER 16A

# STRUCTURAL DESIGN

### SECTION 1601A GENERAL

**1601A.1 Scope.** The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

**1601A.1.1 Application.** *The scope of application of Chapter 16A is as follows:*

1. Applications listed in Section 1.9.2.1, regulated by the Division of the State Architect-Structural Safety (DSA-SS). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.
2. Applications listed in Sections 1.10.1 and 1.10.4, regulated by the Office of Statewide Health Planning and Development (OSHDP). These applications include hospitals, skilled nursing facilities, intermediate care facilities, and correctional treatment centers.

**Exception:** [OSHDP 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 16 and any applicable amendments therein.

**1601A.1.2 Amendments in this chapter.** DSA-SS and OSHDP adopt this chapter and all amendments.

**Exception:** Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. Division of the State Architect-Structural Safety:  
[DSA-SS] – For applications listed in Section 1.9.2.1.
2. Office of Statewide Health Planning and Development:  
[OSHDP 1] – For applications listed in Section 1.10.1.  
[OSHDP 4] – For applications listed in Section 1.10.4.

**1601A.2 Enforcement agency approval.** In addition to the requirements of the California Administrative Code and the California Building Code, any aspect of project design, construction, quality assurance or quality control programs for which this code requires approval by the design professional are also subject to approval by the enforcement agency.

### SECTION 1602A DEFINITIONS AND NOTATIONS

**1602A.1 Definitions.** The following terms are defined in Chapter 2 except those defined below, which shall, for the purposes of this section, have the meanings shown herein.

#### ALLOWABLE STRESS DESIGN.

#### DEAD LOADS.

#### DESIGN STRENGTH.

#### DIAPHRAGM.

Diaphragm, blocked.

Diaphragm boundary.

Diaphragm chord.

Diaphragm flexible.

Diaphragm, rigid.

#### DURATION OF LOAD.

#### ESSENTIAL FACILITIES.

#### FABRIC PARTITION.

#### FACTORED LOAD.

#### HELIPAD.

**HOSPITAL BUILDING.** Any building defined in Section 129725, Health and Safety Code.

#### ICE-SENSITIVE STRUCTURE.

#### IMPACT LOAD.

#### LIMIT STATE.

#### LIVE LOAD.

#### LIVE LOAD (ROOF).

#### LOAD AND RESISTANCE FACTOR DESIGN (LRFD).

#### LOAD EFFECTS.

#### LOAD FACTOR.

#### LOADS.

#### NOMINAL LOADS.

#### OTHER STRUCTURES.

#### PANEL (PART OF A STRUCTURE).

#### RESISTANCE FACTOR.

#### RISK CATEGORY.

#### STRENGTH, NOMINAL.

#### STRENGTH, REQUIRED.

#### STRENGTH DESIGN.

#### SUSCEPTIBLE BAY.

#### VEHICLE BARRIER.

#### NOTATIONS.

$D$  = Dead load.

$D_i$  = Weight of ice in accordance with Chapter 10 of ASCE 7.

- $E$  = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4.2 of ASCE 7.
- $F$  = Load due to fluids with well-defined pressures and maximum heights.
- $F_a$  = Flood load in accordance with Chapter 5 of ASCE 7.
- $H$  = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.
- $L$  = Roof live load greater than 20 psf (0.96 kN/m<sup>2</sup>) and floor live load.
- $L_r$  = Roof live load of 20 psf (0.96 kN/m<sup>2</sup>) or less.
- $R$  = Rain load.
- $S$  = Snow load.
- $T$  = Self-straining load.
- $V_{asd}$  = Nominal design wind speed (3-second gust), miles per hour (mph) (km/hr) where applicable.
- $V_{ult}$  = Ultimate design wind speeds (3-second gust), miles per hour (mph) (km/hr) determined from Figures 1609A, 1609B, or 1609C or ASCE 7.
- $W_i$  = Wind-on-ice in accordance with Chapter 10 of ASCE 7.
- $W$  = Load due to wind pressure.

### SECTION 1603A CONSTRUCTION DOCUMENTS

**1603A.1 General.** Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603A.1.1 through 1603A.1.10 shall be indicated on the construction documents.

**Exception:** Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof live loads.
2. Ground snow load,  $P_g$ .
3. Ultimate design wind speed,  $V_{ult}$ , (3-second gust), miles per hour (mph) (km/hr) and nominal design wind speed,  $V_{asd}$ , as determined in accordance with Section 1609.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612A.3.
6. Design load-bearing values of soils.

**[DSA-SS]** Additional requirements are included in Section 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R.).

**[OSHDP 1]** Additional requirements are included in Section 7-115 and 7-125 of the California Administrative Code (Part 1, Title 24, C.C.R.).

**1603A.1.1 Floor live load.** The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607A.10 shall be indicated for each type of live load used in the design.

**1603A.1.2 Roof live load.** The roof live load used in the design shall be indicated for roof areas (Section 1607A.12).

**1603A.1.3 Roof snow load data.** The ground snow load,  $P_g$ , shall be indicated. In areas where the ground snow load,  $P_g$ , exceeds 10 pounds per square foot (psf) (0.479 kN/m<sup>2</sup>), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load,  $P_f$ .
2. Snow exposure factor,  $C_e$ .
3. Snow load importance factor,  $I$ .
4. Thermal factor,  $C_t$ .

**1603A.1.4 Wind design data.** The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

1. Ultimate design wind speed,  $V_{ult}$ , (3-second gust), miles per hour (km/hr) and nominal design wind speed,  $V_{asd}$ , as determined in accordance with Section 1609.3.1.
2. Risk category.
4. The applicable internal pressure coefficient.
5. Components and cladding. The design wind pressures in terms of psf (kN/m<sup>2</sup>) to be used for the design of exterior component and cladding materials not specifically designed by the registered design professional.

**1603A.1.5 Earthquake design data.** The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. Risk category.
2. Seismic importance factor,  $I_e$ .
3. Mapped spectral response acceleration parameters,  $S_s$  and  $S_1$ .
4. Site class.
5. Design spectral response acceleration parameters,  $S_{DS}$  and  $S_{D1}$ .
6. Seismic design category.
7. Basic seismic force-resisting system(s).
8. Design base shear(s).
9. Seismic response coefficient(s),  $C_s$ .
10. Response modification coefficient(s),  $R$ .
11. Analysis procedure used.
12. Applicable horizontal structural irregularities.

13. *Applicable vertical structural irregularities.*

14. *Location of base as defined in Section 1613A.2.*

**1603A.1.5.1 Connections.** *Connections that resist design seismic forces shall be designed and detailed on the design drawings.*

**1603A.1.6 Geotechnical information.** The design load-bearing values of soils shall be shown on the construction documents.

**1603A.1.7 Flood design data.** For buildings located in whole or in part in flood hazard areas as established in Section 1612A.3, the documentation pertaining to design, if required in Section 1612A.5, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. In flood hazard areas not subject to high-velocity wave action, the elevation of the proposed lowest floor, including the basement.
2. In flood hazard areas not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry floodproofed.
3. In flood hazard areas subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

**1603A.1.8 Special loads.** Special loads that are applicable to the design of the building, structure or portions thereof shall be indicated along with the specified section of this code that addresses the special loading condition.

**1603A.1.9 Systems and components requiring special inspections for seismic resistance.** Construction documents or specifications shall be prepared for those systems and components requiring special inspection for seismic resistance as specified in Section 1707.1 by the registered design professional responsible for their design and shall be submitted for approval in accordance with Section 107.1. Reference to seismic standards in lieu of detailed drawings is acceptable.

**1603A.1.10 Construction procedures.** *Where unusual erection or construction procedures are considered essential by the Registered Design Professional (RDP) in order to accomplish the intent of the design or influence the design, such procedure shall be indicated on the construction documents.*

**1603A.2 Site data reports.** *Geotechnical and geohazard reports for review by the enforcement agency shall be accompanied by a description of the project prepared by the registered design professional (RDP) in responsible charge, which shall include the following:*

1. *Type of service such as general acute care facility, skilled nursing facility, intermediate care facility, acute*

*psychiatric facility, central utility plants, K-12 school, community college, essential services, etc.*

2. *Construction materials used for the project such as steel, concrete, masonry, wood, etc.*
3. *Type of construction such as new, addition, alteration, repair, etc.*
4. *For existing buildings, extent of construction such as incidental, minor, major, and/or voluntary seismic improvements as defined in Section 3418 [DSA-SS] Sections 202 and 3402A.2 [OSHPD 1 & 4].*
5. *Seismic force resisting system used for each structure in the project.*
6. *Foundation system that will be used for each structure in the project such as spread footing, drilled piers, etc.*
7. *Analysis procedure used and basis of design such as ASCE 7 Equivalent Lateral Force Procedure, ASCE 41 Nonlinear Dynamic Procedure, etc.*
8. *Building characteristics such as number of stories above and below grade, foot print area at grade, grade slope on site, etc.*
9. *Special features such as requirement for shoring, underpinning, retaining walls, etc.*

**1603A.3 Structural calculations.** *The application for the approval of construction documents that involves structural elements or components shall be accompanied by complete and accurate structural design computations, which shall comply with requirements prescribed by the enforcement agency:*

1. *The computations shall be preceded by a detailed index.*
2. *The computations including each major subsection shall be prefaced by a statement clearly and concisely outlining the basis for the structural design and indicating the manner in which the structure will resist the vertical loads and lateral forces.*
3. *The computations shall be sufficiently complete to the extent that calculations for the individual structural members and connections can be readily interpreted.*

## SECTION 1604A GENERAL DESIGN REQUIREMENTS

**1604A.1 General.** Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters.

**1604A.2 Strength.** Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other

## STRUCTURAL DESIGN

structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

**1604A.3 Serviceability.** Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift. See Section 12.12.1 of ASCE 7 for drift limits applicable to earthquake loading.

**1604A.3.1 Deflections.** The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604A.3.2 through 1604A.3.6 or that permitted by Table 1604A.3.

**1604A.3.2 Reinforced concrete.** The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

**1604A.3.3 Steel.** The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 or SJI LH/DLH-1.1, as applicable.

**1604A.3.4 Masonry.** The deflection of masonry structural members shall not exceed that permitted by TMS 402/ACI 530/ASCE 5.

**1604A.3.5 Aluminum.** The deflection of aluminum structural members shall not exceed that permitted by AA ADM1.

**1604A.3.6 Limits.** The deflection limits of Section 1604A.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

**1604A.3.7 Horizontal diaphragms.** *The maximum span-width ratio for any roof or floor diaphragm shall not exceed those given in Table 4.2.4 of AF & PA SDPWS for wood or maximum span-depth ratio given in Table 1604A.4 for steel and composite steel-slab decking, unless test data and design calculations acceptable to the enforcement agency are submitted and approved for the use of other span-width or span-depth ratios. Concrete diaphragms shall not exceed the span depth ratios for the equivalent composite steel-slab diaphragm in Table 1604A.4.*

**1604A.3.8 Deflections.** *Deflection criteria for materials not specified shall be developed by the project architect or structural engineer in a manner consistent with the provisions of this section and approved by the enforcement agency.*

**1604A.4 Analysis.** Load effects on structural members and their connections shall be determined by methods of struc-

**TABLE 1604A.3**  
**DEFLECTION LIMITS<sup>a, b, c, h, i</sup>**

CONSTRUCTION	L	S or W <sup>f</sup>	D + L <sup>d, g</sup>
Roof members: <sup>c</sup>			
Supporting plaster or stucco ceiling	l/360	l/360	l/240
Supporting nonplaster ceiling	l/240	l/240	l/180
Not supporting ceiling	l/180	l/180	l/120
Floor members	l/360	—	l/240
Exterior walls and interior partitions:			
With plaster or stucco finishes	—	l/360	—
With other brittle finishes	—	l/240	—
With flexible finishes	—	l/120	—
Veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing		l/600	—
Farm buildings	—	—	l/180
Greenhouses	—	—	l/120

For SI: 1 foot = 304.8 mm.

- For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed l/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed l/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed l/90. For roofs, this exception only applies when the metal sheets have no roof covering.
- Interior partitions not exceeding 6 feet in height and flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.14.
- See Section 2403 for glass supports.
- For wood structural members having a moisture content of less than 16 percent at time of installation and used under dry conditions, the deflection resulting from  $L + 0.5D$  is permitted to be substituted for the deflection resulting from  $L + D$ .
- The above deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to assure adequate drainage shall be investigated for ponding. See Section 1611A for rain and ponding requirements and Section 1503.4 for roof drainage requirements.
- The wind load is permitted to be taken as 0.42 times the "component and cladding" loads for the purpose of determining deflection limits herein.
- For steel structural members, the dead load shall be taken as zero.
- For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers, not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed l/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed l/175 for each glass lite or l/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed l/120.
- For cantilever members, l shall be taken as twice the length of the cantilever.

tural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the added eccentricities expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral-force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral-force-resisting system are permitted to be incorporated into buildings provided their effect on the action of the system is considered and provided for in the design. Except where diaphragms are flexible, or are permitted to be analyzed as flexible, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral-force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter.

See Section 1609A for wind loads, Section 1610A for lateral soil loads and Section 1613A for earthquake loads.

**1604A.5 Risk category.** Each building and structure shall be assigned a risk category in accordance with Table 1604A.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein.

**1604.5A.1 Multiple occupancies.** Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher risk category, both portions shall be assigned to the higher risk category.

**1604A.6 In-situ load tests.** The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1709A.

**1604A.7 Preconstruction load tests.** Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the

**TABLE 1604A.4**  
**MAXIMUM HORIZONTAL DIAPHRAGM SPAN AND SPAN-DEPTH RATIOS<sup>1,3,4</sup>**

FLEXIBILITY FACTOR( $F^2$ )	MAXIMUM DIAPHRAGM SPAN FOR MASONRY OR CONCRETE WALLS (feet)	DIAPHRAGM SPAN-DEPTH LIMITATION			
		Rotation (torsion) Not Considered in Diaphragm		Rotation (torsion) Considered in Diaphragm	
		Masonry or Concrete Walls	Flexible Walls	Masonry or Concrete Walls	Flexible Walls
More than 150	Not to be used	Not to be used	2:1	Not to be used	1 <sup>1</sup> / <sub>2</sub> :1
70-150	200	2:1 or as required for deflection	3:1	Not to be used	2:1
10-70	400	2 <sup>1</sup> / <sub>2</sub> :1 or as required for deflection	4:1	As required for deflection	2 <sup>1</sup> / <sub>2</sub> :1
1-10	No limitation	3:1 or as required for deflection	5:1	As required for deflection	3:1
Less than 1	No limitation	As required for deflection	No limitation	As required for deflection	3 <sup>1</sup> / <sub>2</sub> :1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.594 N/m, 1 psi = 6894 Pa

1. Diaphragms shall satisfy span-depth limitations based on flexibility.

2. Flexibility factor ( $F$ ) is the average deflection in micro inches ( $10^{-6}$ ) or  $\mu\text{m}$  of the diaphragm web per foot (m) of span stressed with a shear of 1 pound per foot (N/m).

3. The total deflection  $\Delta$  of the diaphragm may be computed from the equation:  $\Delta = \Delta_f + \Delta_w$ .

Where:

$\Delta_f$  = Flexural deflection of the diaphragm determined in the same manner as the deflection of beams. The flexural stiffness of the web of diaphragms consisting of bare steel decking shall be neglected.

$\Delta_w$  = Web deflection of the diaphragm may be determined solving the following equation:

$$F = \frac{\Delta_w \times 10^6}{q_{ave} L}$$

Where:

$L$  = Distance in feet (m) between the vertical resisting element (such as a shear wall) and the point to which the deflection is to be determined.

$q_{ave}$  = Average shear in the diaphragm in pounds per foot (N/m) over length  $L$ .

4 When applying these limitations to cantilevered diaphragms, the allowable span-depth ratio will be half of that shown.



**TABLE 1604A.5  
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> <li>• Agricultural facilities.</li> <li>• Certain temporary facilities.</li> <li>• Minor storage facilities.</li> </ul>
II	Buildings and other structures except those listed in Risk Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> <li>• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.</li> <li>• Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than 250.</li> <li>• Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500.</li> <li>• Group I-3 occupancies.</li> <li>• Any other occupancy with an occupant load greater than 5,000<sup>a</sup>.</li> <li>• Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV.</li> <li>• Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: <ul style="list-style-type: none"> <li>Exceed maximum allowable quantities per control area as given in Table 307A.1(1) or 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and</li> <li>Are sufficient to pose a threat to the public if released.<sup>b</sup></li> </ul> </li> </ul>
IV	Buildings and other structures designated as essential facilities, including but not limited to: <ul style="list-style-type: none"> <li>• <b>[OSHPD 1 &amp; 4] Hospital Buildings as defined in the California Administrative Code, Section 7-111 and all structures required for their continuous operation or access/egress.</b></li> <li>• Fire, rescue, ambulance and police stations and emergency vehicle garages.</li> <li>• Designated earthquake, hurricane or other emergency shelters.</li> <li>• Designated emergency preparedness, communications and operations centers and other facilities required for emergency response <b>[DSA-SS] as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.</b></li> <li>• Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.</li> <li>• Buildings and other structures containing quantities of highly toxic materials that: <ul style="list-style-type: none"> <li>Exceed maximum allowable quantities per control area as given in Table 307A.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and</li> <li>Are sufficient to pose a threat to the public if released <sup>b</sup>.</li> </ul> </li> <li>• Aviation control towers, air traffic control centers and emergency aircraft hangars.</li> <li>• Buildings and other structures having critical national defense functions.</li> <li>• Water storage facilities and pump structures required to maintain water pressure for fire suppression.</li> </ul>

a. For purposes of occupant load calculation, occupancies required by Table 1004A.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

applicable referenced standards, or alternative test procedures in accordance with Section 1707, shall be load tested in accordance with Section 1710A.

**1604A.8 Anchorage.** Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604A.8.1 through 1604A.8.3, as applicable.

**1604A.8.1 General.** Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall

be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

**1604A.8.2 Structural walls.** Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces specified in Section 1.4.4 of ASCE 7 for walls of structures assigned

to Seismic Design Category A and to Section 12.11 of ASCE 7 for walls of structures assigned to all other seismic design categories. *For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.* Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609A for wind design requirements and 1613A for earthquake design requirements.

**1604A.8.3 Decks.** Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607A.1, or the snow load specified in Section 1608A, in accordance with Section 1605A, acting on all portions of the deck.
2. The reactions resulting from the dead load and live load specified in Table 1607A.1, or the snow load specified in Section 1608A, in accordance with Section 1605A, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

**1604A.9 Counteracting structural actions.** Structural members, systems, components and cladding shall be designed to resist forces due to earthquake and wind, with consideration of overturning, sliding and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

**1604A.10 Wind and seismic detailing.** Lateral-force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7, excluding Chapter 14 and Appendix 11A, even when wind load effects are greater than seismic load effects.

## SECTION 1605A LOAD COMBINATIONS

**1605A.1 General.** Buildings and other structures and portions thereof shall be designed to resist:

1. The load combinations specified in Section 1605A.2, 1605A.3.1 or 1605A.3.2,
2. The load combinations specified in Chapters 18 through 23, and
3. The seismic load effects including overstrength factor in accordance with Section 12.4.3 of ASCE 7 where required by Section 12.2.5.2, 12.3.3.3 or 12.10.2.1 of ASCE 7. With the simplified procedure of ASCE 7

Section 12.14, the seismic load effects including overstrength factor in accordance with Section 12.14.3.2 of ASCE 7 shall be used.

Applicable loads shall be considered, including both earthquake and wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

Where the load combinations with overstrength factor in Section 12.4.3.2 of ASCE 7 apply, they shall be used as follows:

1. The basic combinations for strength design with overstrength factor in lieu of Equations 16-5 and 16-7 in Section 1605A.2.
2. The basic combinations for allowable stress design with overstrength factor in lieu of Equations 16-12, 16-14 and 16-16 in Section 1605A.3.1.
3. The basic combinations for allowable stress design with overstrength factor in lieu of Equations 16-21 and 16-22 in Section 1605A.3.2.

**1605A.1.1 Stability.** Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 1605A.2 or 1605A.3 shall be permitted. Where the load combinations specified in Section 1605A.2 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807A.2.3. *When using allowable stress design, factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported.*

**1605A.2 Load combinations using strength design or load and resistance factor design.** Where strength design or load and resistance factor design is used, buildings and other structures, and portions thereof, shall be designed to resist the most critical effects resulting from the following combinations of factored loads:

$$1.4(D + F) \quad \text{(Equation 16A-1)}$$

$$1.2(D + F) + 1.6(L + H) + 0.5(L_r \text{ or } S \text{ or } R) \quad \text{(Equation 16A-2)}$$

$$1.2(D + F) + 1.6(L_r \text{ or } S \text{ or } R) + 1.6H + (f_1 L \text{ or } 0.5W) \quad \text{(Equation 16A-3)}$$

$$1.2(D + F) + 1.0W + f_1 L + 1.6H + 0.5(L_r \text{ or } S \text{ or } R) \quad \text{(Equation 16A-4)}$$

$$1.2(D + F) + 1.0E + f_1 L + 1.6H + f_2 S \quad \text{(Equation 16A-5)}$$

$$0.9D + 1.0W + 1.6H \quad \text{(Equation 16A-6)}$$

$$0.9(D + F) + 1.0E + 1.6H \quad \text{(Equation 16A-7)}$$

where:

$f_1 = 1$  for places of public assembly live loads in excess of 100 pounds per square foot (4.79 kN/m<sup>2</sup>), and parking garages; and 0.5 for other live loads.

$f_2 = 0.7$  for roof configurations (such as saw tooth) that do not shed snow off the structure, and 0.2 for other roof configurations.

**Exceptions:**

1. Where other factored load combinations are specifically required by other provisions of this code, such combinations shall take precedence.
2. Where the effect of  $H$  resists the primary variable load effect, a load factor of 0.9 shall be included with  $H$  where  $H$  is permanent and  $H$  shall be set to zero for all other conditions.

**1605.2.1 Other loads.** Where flood loads,  $F_a$ , are to be considered in the design, the load combinations of Section 2.3.3 of ASCE 7 shall be used. Where self-straining loads,  $T$ , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.3.5 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.3.4 of ASCE 7 shall be considered.

**1605A.3 Load combinations using allowable stress design.**

**1605A.3.1 Basic load combinations.** Where allowable stress design (working stress design), as permitted by this code, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

$$D + F \quad (\text{Equation 16A-8})$$

$$D + H + F + L \quad (\text{Equation 16A-9})$$

$$D + H + F + (L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16A-10})$$

$$D + H + F + 0.75(L) + 0.75(L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16A-11})$$

$$D + H + F + (0.6W \text{ or } 0.7E) \quad (\text{Equation 16A-12})$$

$$D + H + F + 0.75(0.6W) + 0.75L + 0.75(L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16A-13})$$

$$D + H + F + 0.75(0.7E) + 0.75L + 0.75S \quad (\text{Equation 16A-14})$$

$$0.6D + 0.6W + H \quad (\text{Equation 16A-15})$$

$$0.6(D + F) + 0.7E + H \quad (\text{Equation 16A-16})$$

**Exceptions:**

1. Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 psf (1.44 kN/m<sup>2</sup>) or less and roof live loads of 30 psf or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m<sup>2</sup>), 20 percent shall be combined with seismic loads.
3. Where the effect of  $H$  resists the primary variable load effect, a load factor of 0.6 shall be included with  $H$  where  $H$  is permanent and  $H$  shall be set to zero for all other conditions.

4. In Equation 16-15, the wind load,  $W$ , is permitted to be reduced in accordance with Exception 2 of Section 2.4.1 of ASCE 7.

5. In Equation 16-16, 0.6  $D$  is permitted to be increased to 0.9  $D$  for the design of special reinforced masonry shear walls complying with Chapter 21.

**1605A.3.1.1 Stress increases.** Increases in allowable stresses specified in the appropriate material chapter or the referenced standards shall not be used with the load combinations of Section 1605A.3.1, except that increases shall be permitted in accordance with Chapter 23.

**1605.3.1.2 Other loads.** Where flood loads,  $F_a$ , are to be considered in design, the load combinations of Section 2.4.2 of ASCE 7 shall be used. Where self-straining loads,  $T$ , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7. Where an ice-sensitive structure is subjected to loads due to atmospheric icing, the load combinations of Section 2.4.3 of ASCE 7 shall be considered.

**1605.3.2 Alternative basic load combinations.** In lieu of the basic load combinations specified in Section 1605.3.1, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. When using these alternative basic load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. When using allowable stresses which have been increased or load combinations which have been reduced as permitted by the material chapter of this code or the referenced standards, where wind loads are calculated in accordance with Chapters 26 through 31 of ASCE 7, the coefficient ( $\omega$ ) in the following equations shall be taken as 1.3. For other wind loads, ( $\omega$ ) shall be taken as 1. When allowable stresses have not been increased or load combinations have not been reduced as permitted by the material chapter of this code or the referenced standards, ( $\omega$ ) shall be taken as 1. When using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. When using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect,  $E_v$ , in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero.

$$D + L + (L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16A-17})$$

$$D + L + 0.6 \omega W \quad (\text{Equation 16A-18})$$

$$D + L + 0.6 \omega W + S/2 \quad (\text{Equation 16A-19})$$

$$D + L + S + 0.6 \omega W/2 \quad (\text{Equation 16A-20})$$

$$D + L + S + E/1.4 \quad (\text{Equation 16A-21})$$

$$0.9D + E/1.4 \quad (\text{Equation 16A-22})$$

**Exceptions:**

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 psf (1.44 kN/m<sup>2</sup>) or less and roof live loads of 30 psf or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m<sup>2</sup>), 20 percent shall be combined with seismic loads.

**1605.3.2.1 Other loads.** Where  $F$ ,  $H$  or  $T$  are to be considered in the design, each applicable load shall be added to the combinations specified in Section 1605A.3.2. Where self-straining loads,  $T$ , are considered in design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7..

## SECTION 1606A DEAD LOADS

**1606A.1 General.** Dead loads are those loads defined in Section 1602A.1. Dead loads shall be considered permanent loads.

**1606A.2 Design dead load.** For purposes of design, the actual weights of materials of construction and fixed service equipment shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

**1606A.3 Roof dead loads.** *The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1510.*

## SECTION 1607A LIVE LOADS

**1607A.1 General.** Live loads are those loads defined in Section 1602A.1.

**1607A.2 Loads not specified.** For occupancies or uses not designated in Table 1607A.1, the live load shall be determined in accordance with a method approved by the building official.

**1607A.3 Uniform live loads.** The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed live loads given in Table 1607A.1.

**1607A.4 Concentrated live loads.** Floors and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607A.3 or the concentrated live loads, in pounds (kiloNewtons), given in Table 1607A.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be

assumed to be uniformly distributed over an area of 2½ feet by 2½ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

**1607A.5 Partition loads.** In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load exceeds 80 psf (3.83 kN/m<sup>2</sup>). The partition load shall not be less than a uniformly distributed live load of 15 psf (0.74 kN/m<sup>2</sup>).

**1607A.6 Helipads.** Helipads shall be designed for the following live loads:

1. A uniform live load,  $L$ , as specified below. This load shall not be reduced.
  - 1.1. 40 psf (1.92 kN/m<sup>2</sup>) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.
  - 1.2. 60 psf (2.87 kN/m<sup>2</sup>) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).
2. A single concentrated live load,  $L$ , of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.
3. Two single concentrated live loads,  $L$ , 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000 pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

**1607A.7 Heavy vehicle loads.** Floors and other surfaces that are intended to support vehicle loads greater than a 10,000 pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607A.7.1 through 1607A.7.5.

**1607A.7.1 Loads.** Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue,

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in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

**1607A.7.2 Fire truck and emergency vehicles.** Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official; or
2. The live loading specified in Section 1607A.7.1.

**1607A.7.3 Heavy vehicle garages.** Garages designed to accommodate vehicles that exceed a 10,000 pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607A.7.1. For garages the design for impact and fatigue is not required.

**Exception:** The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided such loads and placement are based on rational engineering principles and are approved by the building official, but shall not be less than 50 psf (2.9 kN/m<sup>2</sup>). This live load shall not be reduced.

**1607A.7.4 Forklifts and movable equipment.** Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted per Section 1607A.7.5.

**1607A.7.4.1 Impact and fatigue.** Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

**1607A.7.5 Posting.** The maximum weight of the vehicles allowed into or on a garage or other structure shall be posted by the owner in accordance with Section 106A.1.

**1607A.8 Loads on handrails, guards, grab bars, seats and vehicle barriers.** Handrails, guards, grab bars, accessible seats, accessible benches and vehicle barriers shall be designed and constructed to the structural loading conditions set forth in this section.

**1607A.8.1 Handrails and guards.** Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section

4.5.1 of ASCE 7. Glass handrail assemblies and guards shall also comply with Section 2407A.

**Exceptions:**

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607A.8.1.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

**1607A.8.1.1 Concentrated load.** Handrails and guards shall also be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

**1607A.8.1.2 Intermediate rails.** Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1 of ASCE 7.

**1607A.8.2 Grab bars, shower seats and dressing room bench seats.** Grab bars, shower seats and dressing room bench seat systems shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar or seat so as to produce the maximum load effects. *[DSA-AC] See Chapter 11A, Section 1127A.4, and Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.*

**1607A.8.3 Vehicle barriers.** Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

**1607A.9 Impact loads.** The live loads specified in Sections 1607A.3 through 1607A.8 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

**1607A.9.1 Elevators.** Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1.

**1607A.9.2 Machinery.** For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact: (1) light machinery, shaft- or motor-driven, 20 percent; and (2) reciprocating machinery or power-driven units, 50 percent. Percentages shall be increased where specified by the manufacturer.

**TABLE 1607A.1**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ , AND**  
**MINIMUM CONCENTRATED LIVE LOADS<sup>g</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
1. Apartments (see residential)	—	—
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150 <sup>m</sup>	—
4. Assembly areas		
Fixed seats (fastened to floor)	60 <sup>m</sup>	
Follow spot, projections and control rooms	50	
Lobbies	100 <sup>m</sup>	—
Movable seats	100 <sup>m</sup>	
Stage floors	150 <sup>m</sup>	
Platforms (assembly)	100 <sup>m</sup>	
Other assembly areas	100 <sup>m</sup>	
5. Balconies and decks <sup>h</sup>	Same as occupancy served	—
6. Catwalks	40	300
7. Cornices	60	—
8. Corridors		
First floor	100	
Other floors	Same as occupancy served except as indicated	—
9. Dining rooms and restaurants	100 <sup>m</sup>	—
10. Dwellings (see residential)	—	—
11. Elevator machine room grating (on area of 2 inches by 2 inches)	—	300
12. Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200
13. Fire escapes	100	
On single-family dwellings only	40	—
14. Garages (passenger vehicles only)	40 <sup>m</sup>	Note a
Trucks and buses	See Section 1607.7	
15. Handrails, guards and grab bars	See Section 1607.8	
16. Helipads	See Section 1607.6	
17. Hospitals		
Corridors above first floor	100	1,000
Operating rooms, laboratories	60	1,000
Patient rooms	40	1,000
<i>[OSHPD 1 &amp; 4]</i>		
<i>Mechanical and electrical equipment areas including open areas around equipment</i>	50	
<i>Storage</i>		
<i>Light</i>	125	
<i>Heavy</i>	250	
<i>Dining Area (not used for assembly)</i>	100	1,000
<i>Kitchen and serving areas</i>	50	1,000
18. Hotels (see residential)	—	—
19. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150 <sup>b, m</sup>	1,000
20. Manufacturing		
Heavy	250 <sup>m</sup>	3,000
Light	125 <sup>m</sup>	2,000
21. Marquees	75	—

(continued)

**TABLE 1607A.1—continued**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ , AND**  
**MINIMUM CONCENTRATED LIVE LOADS<sup>g</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
22. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000
23. Penal institutions		
Cell blocks	40	—
Corridors	100	—
24. Recreational uses:		
Bowling alleys, poolrooms and similar uses	75 <sup>m</sup>	
Dance halls and ballrooms	100 <sup>m</sup>	
Gymnasiums	100 <sup>m</sup>	—
Reviewing stands, grandstands and bleachers	100 <sup>c, m</sup>	
Stadiums and arenas with fixed seats (fastened to floor)	60 <sup>c, m</sup>	
25. Residential		
One- and two-family dwellings		
Uninhabitable attics without storage <sup>i</sup>	10	
Uninhabitable attics with storage <sup>i, j, k</sup>	20	
Habitable attics and sleeping areas <sup>k</sup>	30	
All other areas	40	—
Hotels and multifamily dwellings		
Private rooms and corridors serving them	40	
Public rooms <sup>m</sup> and corridors serving them	100	
26. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5	
All other construction	20	
Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	
Where primary roof members are exposed to a work floor, at single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs:		
Over manufacturing, storage warehouses, and repair garages		2,000
All other primary roof members		300
Occupiable roofs:		
Roof gardens	100	
Assembly areas	100 <sup>m</sup>	
All other similar areas	Note 1	Note 1
27. Schools		
Classrooms	40	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
28. Scuttles, skylight ribs and accessible ceilings	—	200
29. Sidewalks, vehicular drive ways and yards, subject to trucking	250 <sup>d, m</sup>	8,000 <sup>e</sup>

(continued)

**TABLE 1607A.1—continued**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ ,**  
**AND MINIMUM CONCENTRATED LIVE LOADS<sup>a</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
30. Stairs and exits One- and two-family dwellings All other	40 100	300 <sup>f</sup> 300 <sup>f</sup>
31. Storage warehouses (shall be designed for heavier loads if required for anticipated storage) Heavy Light	250 <sup>m</sup> 125 <sup>m</sup>	—
32. Stores Retail First floor Upper floors Wholesale, all floors	100 75 125 <sup>m</sup>	1,000 1,000 1,000
33. Vehicle barriers	See Section 1607.8.3	
34. Walkways and elevated platforms (other than exitways)	60	—
35. Yards and terraces, pedestrians	100 <sup>m</sup>	—
36. Storage racks and wall-hung cabinets.	Total loads <sup>n</sup>	

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>,  
1 square foot = 0.0929 m<sup>2</sup>,  
1 pound per square foot = 0.0479 kN/m<sup>2</sup>, 1 pound = 0.004448 kN,  
1 pound per cubic foot = 16 kg/m<sup>3</sup>.

- a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches; (2) for mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds per wheel.
- b. The loading applies to stack room floors that support nonmobile, double-faced library bookstacks, subject to the following limitations:
1. The nominal bookstack unit height shall not exceed 90 inches;
  2. The nominal shelf depth shall not exceed 12 inches for each face; and
  3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches wide.
- c. Design in accordance with ICC 300.
- d. Other uniform loads in accordance with an approved method containing provisions for truck loadings shall also be considered where appropriate.
- e. The concentrated wheel load shall be applied on an area of 4.5 inches by 4.5 inches.
- f. The minimum concentrated load on stair treads shall be applied on an area of 2 inches by 2 inches. This load need not be assumed to act concurrently with the uniform load.
- g. Where snow loads occur that are in excess of the design conditions, the structure shall be designed to support the loads due to the increased loads caused by drift buildup or a greater snow design determined by the building official (see Section 1608A). For special-purpose roofs, see Section 1607A.11.2.2.
- h. See Section 1604A.8.3 for decks attached to exterior walls.
- i. Uninhabitable attics without storage are those where the maximum clear height between the joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- j. Uninhabitable attics with storage are those where the maximum clear height between the joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:
- i. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches; and
  - ii. The slopes of the joists or truss bottom chords are no greater than two units vertical in 12 units horizontal.
- The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 lb./ft<sup>2</sup>.
- k. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.
- l. Areas of occupiable roofs, other than roof gardens and assembly areas, shall be designed for appropriate loads as approved by the building official. Unoccupied landscaped areas of roofs shall be designed in accordance with Section 1607A.12.3.
- m. Live load reduction is not permitted unless specific exceptions of Section 1607A.10 apply.

**Table Notes TABLE 1607A.1—continued**

- n. The minimum vertical design live load shall be as follows:

Paper media:

12-inch-deep shelf 33 pounds per lineal foot  
15-inch-deep shelf 41 pounds per lineal foot, or  
33 pounds per cubic foot per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep shelf 100 pounds per lineal foot, or  
50 pounds per cubic foot per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot or 20 pounds per square foot, whichever is less, but not less than actual loads.

- o. [DSA-SS] The following minimum loads for stage accessories apply:

1. Gridirons and fly galleries: 75 pounds per square foot uniform live load.
2. Loft block wells: 250 pounds per lineal foot vertical load and lateral load.
3. Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads. Sheave blocks shall be designed with a safety factor of five.
4. Scenery beams where there is no gridiron: 300 pounds per lineal foot vertical load and lateral load.
5. Ceiling framing over stages shall be designed for a uniform live load of 20 pounds per square foot. For members supporting a tributary area of 200 square feet or more, this additional load may be reduced to 15 pounds per square foot.

- p. [DSA-SS] The minimum uniform live load for classroom occupancies is 50 psf. Live load reduction is not permitted for classrooms classified as Group A occupancies unless specific exception of Section 1607A.10 apply.

- q. [DSA-SS] The minimum uniform live load for a press box floor or accessible roof with railing is 100 psf.

- r. [DSA-SS] Item 35 applies to pedestrian bridges and walkways that are not subjected to uncontrolled vehicle access.

**1607A.10 Reduction in uniform live loads.** Except for uniform live loads at roofs, all other minimum uniformly distributed live loads,  $L_o$ , in Table 1607A.1 are permitted to be reduced in accordance with Section 1607A.10.1 or 1607A.10.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607A.12.2.

**1607A.10.1 Basic uniform live load reduction.** Subject to the limitations of Sections 1607A.10.1.1 through 1607A.10.1.3 and Table 1607A.1, members for which a value of  $K_{LL}A_T$  is 400 square feet (37.16 m<sup>2</sup>) or more are permitted to be designed for a reduced uniformly distributed live load,  $L$ , in accordance with the following equation:

(Equation 16A-22)

$$L = L_o \left( 0.25 + \frac{15}{\sqrt{K_{LL}A_T}} \right)$$

$$\text{For SI: } L = L_o \left( 0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}} \right)$$

where:

$L$  = Reduced design live load per square foot (m<sup>2</sup>) of area supported by the member.

$L_o$  = Unreduced design live load per square foot (m<sup>2</sup>) of area supported by the member (see Table 1607A.1).

$K_{LL}$  = Live load element factor (see Table 1607A.10.1).

$A_T$  = Tributary area, in square feet (square meters).

$L$  shall not be less than  $0.50L_o$  for members supporting one floor and  $L$  shall not be less than  $0.40L_o$  for members supporting two or more floors.

**TABLE 1607A.10.1**  
**LIVE LOAD ELEMENT FACTOR,  $K_{LL}$**

ELEMENT	$K_{LL}$
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
All other members not identified above including: Edge beams with cantilever slabs Cantilever beams One-way slabs Two-way slabs Members without provisions for continuous shear transfer normal to their span	1

**1607A.10.1.1 One-way slabs.** The tributary area,  $A_T$ , for use in Equation 16A-23 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

**1607A.10.1.2 Heavy live loads.** Live loads that exceed 100 psf (4.79 kN/m<sup>2</sup>) shall not be reduced.

**Exceptions:**

1. The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than  $L$  as calculated in Section 1607A.10.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

**1607A.10.1.3 Passenger vehicle garages.** The live loads shall not be reduced in passenger vehicle garages.

**Exception:** The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than  $L$  as calculated in Section 1607A.10.1.

**1607A.10.2 Alternative uniform live load reduction.** As an alternative to Section 1607A.10.1 and subject to the limitations of Table 1607A.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m<sup>2</sup>) except that the design live load for members supporting two or more floors is permitted to be reduced by a maximum of 20 percent.

**Exception:** For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent.
3. For live loads not exceeding 100 psf (4.79 kN/m<sup>2</sup>), the design live load for any structural member supporting 150 square feet (13.94 m<sup>2</sup>) or more is permitted to be reduced in accordance with Equation 16A-24.
4. For one-way slabs, the area,  $A$ , for use in Equation 16A-24 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

$$R = 0.08(A - 150) \quad \text{(Equation 16A-24)}$$

$$\text{For SI: } R = 0.861(A - 13.94)$$

Such reduction shall not exceed the smallest of:

1. 40 percent for horizontal members;
2. 60 percent for vertical members; or
3.  $R$  as determined by the following equation.

$$R = 23.1(1 + D/L_o) \quad \text{(Equation 16A-25)}$$

where:

$A$  = Area of floor supported by the member, square feet (m<sup>2</sup>).

$D$  = Dead load per square foot (m<sup>2</sup>) of area supported.

$L_o$  = Unreduced live load per square foot (m<sup>2</sup>) of area supported.

$R$  = Reduction in percent.

**1607A.11 Distribution of floor loads.** Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. It shall be permitted to reduce floor live loads in accordance with Section 1607A.10.

**1607A.12 Roof loads.** The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607A.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

**1607A.12.1 Distribution of roof loads.** Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m<sup>2</sup>) in accordance with Section 1607A.12.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect. See Section 1607A.12.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

**1607A.12.2 General.** The minimum uniformly distributed live loads of roofs and marquees,  $L_o$ , in Table 1607A.1 are



permitted to be reduced in accordance with Section 1607A.12.2.1.

**1607A.12.2.1 Ordinary roofs, awnings and canopies.**

Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load,  $L_r$ , as specified in the following equations or other controlling combinations of loads as specified in Section 1605A, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m<sup>2</sup>).

$$L_r = L_o R_1 R_2 \quad \text{(Equation 16A-26)}$$

where:  $12 \leq L_r \leq 20$

For SI:  $L_r = L_o R_1 R_2$

where:  $0.58 \leq L_r \leq 0.96$

$L_o$  = Unreduced roof live load per square foot (m<sup>2</sup>) of horizontal projection supported by the member (see Table 1607A.1).

$L_r$  = Reduced roof live load per square foot (m<sup>2</sup>) of horizontal projection supported by the member.

The reduction factors  $R_1$  and  $R_2$  shall be determined as follows:

$$R_1 = 1 \text{ for } A_i \leq 200 \text{ square feet} \quad \text{(Equation 16A-27)}$$

(18.58 m<sup>2</sup>)

$$R_1 = 1.2 - 0.001A_i \text{ for } 200 \text{ square feet} < A_i < 600 \text{ square feet} \quad \text{(Equation 16A-28)}$$

For SI:  $1.2 - 0.011A_i$  for  $18.58 \text{ square meters} < A_i < 55.74 \text{ square meters}$

$$R_1 = 0.6 \text{ for } A_i \geq 600 \text{ square feet} \quad \text{(Equation 16A-29)}$$

(55.74 m<sup>2</sup>)

where:

$A_i$  = Tributary area (span length multiplied by effective width) in square feet (m<sup>2</sup>) supported by the member, and

$$R_2 = 1 \text{ for } F \leq 4 \quad \text{(Equation 16A-30)}$$

$$R_2 = 1.2 - 0.05 F \text{ for } 4 < F < 12 \quad \text{(Equation 16A-31)}$$

$$R_2 = 0.6 \text{ for } F \geq 12 \quad \text{(Equation 16A-32)}$$

where:

$F$  = For a sloped roof, the number of inches of rise per foot (for SI:  $F = 0.12 \times \text{slope}$ , with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

**1607.12.3 Occupiable roofs.** Areas of roofs that are occupiable, such as roof gardens, or for assembly or other similar purposes, and marquees are permitted to have their

uniformly distributed live loads reduced in accordance with Section 1607.10.

**1607.12.3.1 Landscaped roofs.** The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf (0.958 kN/m<sup>2</sup>). The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

**1607A.12.4 Awnings and canopies.** Awnings and canopies shall be designed for uniform live loads as required in Table 1607A.1 as well as for snow loads and wind loads as specified in Sections 1608A and 1609A.

**1607A.12.5 Uncovered open-frame roof structures.** *Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m<sup>2</sup>) of the total area encompassed by the framework.*

**1607A.13 Crane loads.** The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

**1607A.13.1 Maximum wheel load.** The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

**1607A.13.2 Vertical impact force.** The maximum wheel loads of the crane shall be increased by the percentages shown below to determine the induced vertical impact or vibration force:

Monorail cranes (powered) . . . . .	25 percent
Cab-operated or remotely operated bridge cranes (powered) . . . . .	25 percent
Pendant-operated bridge cranes (powered) . . . . .	10 percent
Bridge cranes or monorail cranes with hand-gear bridge, trolley and hoist . . . . .	0 percent

**1607A.13.3 Lateral force.** The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with due regard to the lateral stiffness of the runway beam and supporting structure.

**1607A.13.4 Longitudinal force.** The longitudinal force on crane runway beams, except for bridge cranes with hand-gear bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

**1607A.14 Interior walls and partitions.** Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m<sup>2</sup>). *The 5 psf (0.24 kN/m<sup>2</sup>) working load need not be applied simultaneously with wind or seismic loads. The deflection of such walls under a load of 5 psf (0.24 kN/m<sup>2</sup>) shall not exceed the limits in Table 1604A.3.*

**Exception:** Fabric partitions complying with Section 1607A.14.1 shall not be required to resist the minimum horizontal load of 5 psf (0.24 kN/m<sup>2</sup>).

**1607A.14.1 Fabric partitions.** Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the following load conditions:

1. A horizontal distributed load of 5 psf (0.24 kN/m<sup>2</sup>) applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch diameter (203 mm) area [50.3 square inches (32 452 mm<sup>2</sup>)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

## SECTION 1608A SNOW LOADS

**1608A.1 General.** Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall not be less than that determined by Section 1607A.

**1608A.2 Ground snow loads.** The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figure 1608A.2 for the contiguous United States. Site-specific case studies shall be made in areas designated "CS" in Figure 1608A.2. Ground snow loads for sites at elevations above the limits indicated in Figure 1608A.2 and for all sites within the CS areas shall be approved. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval).

**1608A.3 Ponding instability.** Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Section 7.11 of ASCE 7.

**1608A.4 Determination of snow loads.** [DSA-SS] *The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA.*

## SECTION 1609A WIND LOADS

**1609A.1 Applications.** Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

**1609A.1.1 Determination of wind loads.** Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7 or provisions of the alternate all-heights method in Section 1609A.6. The type of opening protection required, the ultimate design wind speed,  $V_{ult}$ , and the exposure category for a site is permitted to be determined in accordance with Section 1609A or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

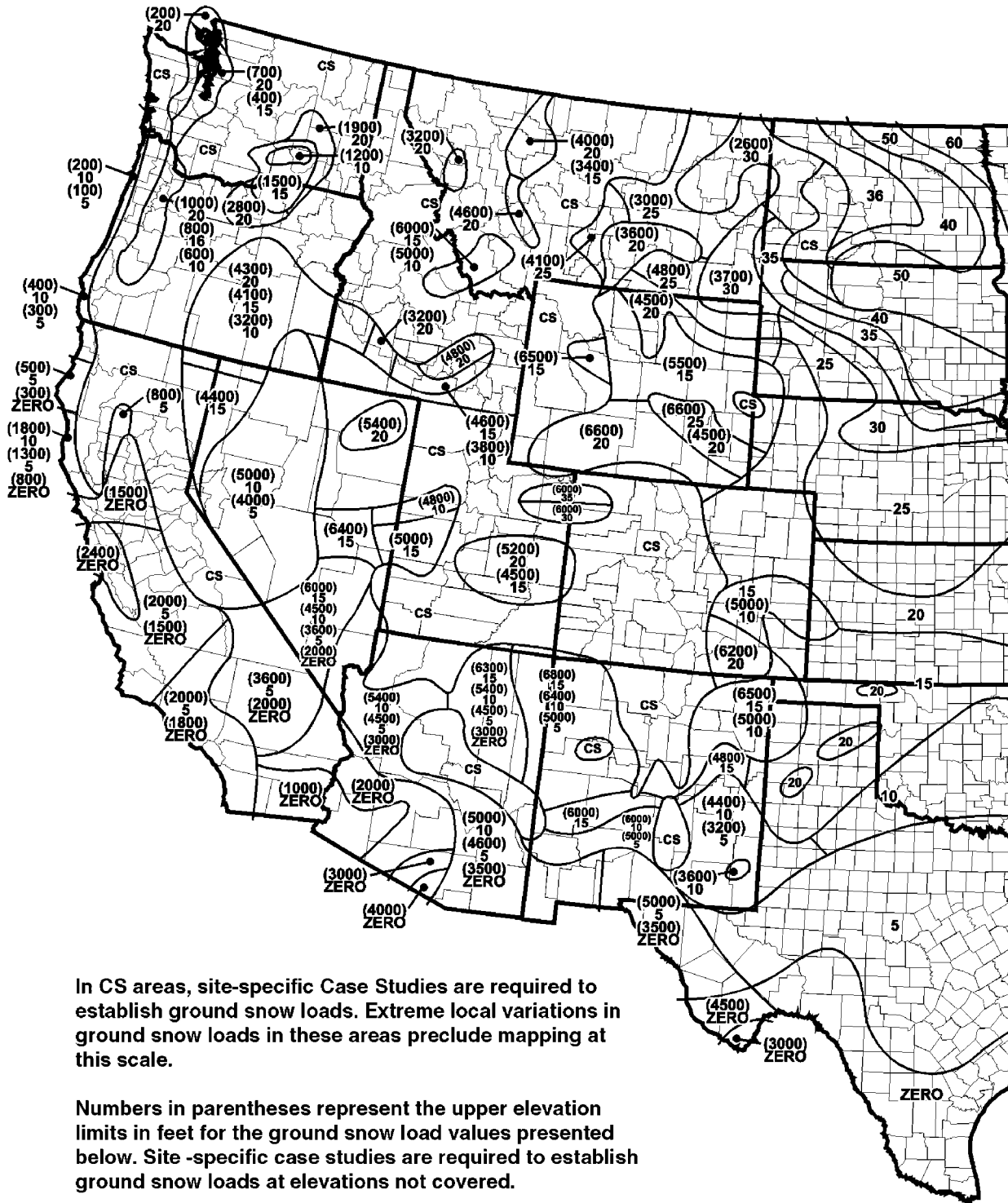
### Exceptions:

1. Subject to the limitations of Section 1609A.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609A.1.1.1, residential structures using the provisions of the AF&PA WFCM.
3. Subject to the limitations of Section 1609A.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with Chapter 31 of ASCE 7.

The wind speeds in Figures 1609A, 1609B and 1609C are ultimate design wind speeds,  $V_{ult}$ , and shall be converted in accordance with Section 1609.3.1 to nominal design wind speeds,  $V_{asd}$ , when the provisions of the standards referenced in Exceptions 1 through 5 are used.

**1609A.1.1.1 Applicability.** The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609A.4. The provisions of ICC 600, AF&PA WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;
2. The maximum average slope of the hill exceeds 10 percent; and
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.



To convert lb/sq ft to  $\text{kNm}^2$ , multiply by 0.0479.

To convert feet to meters, multiply by 0.3048.

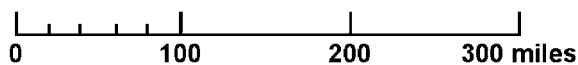


FIGURE 1608.A.2  
GROUND SNOW LOADS,  $p_g$ , FOR THE UNITED STATES (psf)



**FIGURE 1608.A.2—continued**  
**GROUND SNOW LOADS,  $p_g$ , FOR THE UNITED STATES (psf)**

**1609A.1.2 Protection of openings.** In wind-borne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E 1996 and ASTM E 1886 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E 1996.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E 1996.

**Exceptions:**

1. Wood structural panels with a minimum thickness of  $\frac{7}{16}$  inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings classified as Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609A.1.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where  $V_{asd}$  determined in accordance with Section 1609A.3.1 does not exceed 140 mph (63 m/s).
2. Glazing in Risk Category I buildings as defined in Section 1604A.5, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Risk Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

**1609A.1.2.1 Louvers.** Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet requirements of an approved impact-resisting standard or the large missile test of AMCA 54.

**TABLE 1609A.1.2**  
**WIND-BORNE DEBRIS PROTECTION FASTENING SCHEDULE**  
**FOR WOOD STRUCTURAL PANELS<sup>a, b, c, d</sup>**

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
$\frac{1}{4}$ -inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N,  
1 mile per hour = 0.447 m/s.

- a. This table is based on 140 mph wind speeds and a 45-foot mean roof height.
- b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located a minimum of 1 inch from the edge of the panel.
- c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located a minimum of  $2\frac{1}{2}$  inches from the edge of concrete block or concrete.
- d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

**1609A.1.2.2. Application of ASTM E 1996.** The text of Section 6.2.2 of ASTM E 1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the strength design wind speed,  $V_{ult}$ , as follows:

6.2.2.1 *Wind Zone 1*—130 mph ≤ ultimate design wind speed,  $V_{ult} < 140$  mph.

6.2.2.2 *Wind Zone 2*—140 mph ≤ ultimate design wind speed,  $V_{ult} < 150$  mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 *Wind Zone 3*—150 mph (58 m/s) ≤ ultimate design wind speed,  $V_{ult} ≤ 160$  mph (63 m/s), or 140 mph (54 m/s) ≤ ultimate design wind speed,  $V_{ult} ≤ 160$  mph (63 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 *Wind Zone 4*—ultimate design wind speed,  $V_{ult} > 160$  mph (63 m/s).

**1609A.1.2.3 Garage doors.** Garage door glazed opening protection for wind-borne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

**1609A.1.3 Story drift for wind loads.** The calculated story drift due to wind pressures with ultimate design wind speed,  $V_{ult}$ , shall not exceed 0.008 times the story height for buildings less than 65 feet (19 812 mm) in height or 0.007 times the story height for buildings 65 feet (19 812 mm) or greater in height.

**Exception:** This story drift limit need not be applied for single-story open structures.

**1609A.2 Definitions.** For the purposes of Section 1609A and as used elsewhere in this code, the following terms are defined in Chapter 2.

#### HURRICANE-PRONE REGIONS.

#### WIND-BORNE DEBRIS REGION.

**WIND SPEED,  $V_{ult}$ .**

**WIND SPEED,  $V_{asd}$ .**

**1609A.3 Basic wind speed.** The ultimate design wind speed,  $V_{ult}$ , in mph, for the determination of the wind loads shall be determined by Figures 1609A, 1609B and 1609C. The ultimate design wind speed,  $V_{ult}$ , for use in the design of Risk Category II buildings and structures shall be obtained from Figure 1609A. The ultimate design wind speed,  $V_{ult}$ , for use in the design of Risk Category III and IV buildings and structures shall be obtained from Figure 1609B. The ultimate design wind speed,  $V_{ult}$ , for use in the design of Risk Category I buildings and structures shall be obtained from Figure 1609C. The ultimate design wind speed,  $V_{ult}$ , for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The ultimate design wind speeds,  $V_{ult}$ , determined by the local jurisdiction shall be in accordance with Section 26.5.1 of ASCE 7.

In nonhurricane-prone regions, when the ultimate design wind speed,  $V_{ult}$ , is estimated from regional climatic data, the ultimate design wind speed,  $V_{ult}$ , shall be determined in accordance with Section 26.5.3 of ASCE 7.

**1609A.3.1 Wind speed conversion.** When required, the ultimate design wind speeds of Figures 1609A, 1609B and 1609C shall be converted to nominal design wind speeds,  $V_{asd}$ , using Table 1609A.3.1 or Equation 16-33.

$$V_{asd} = V_{ult} \sqrt{0.6}$$

(Equation 16A-33)

where:

$V_{asd}$  = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.

$V_{ult}$  = ultimate design wind speeds determined from Figures 1609A, 1609B or 1609C.

**1609A.4 Exposure category.** For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

**1609A.4.1 Wind directions and sectors.** For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609A.4.2 and 1609A.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

**1609A.4.2 Surface roughness categories.** A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609A.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609A.4.3.

**Surface Roughness B.** Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

**Surface Roughness C.** Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

**Surface Roughness D.** Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

**TABLE 1609A.3.1**  
**WIND SPEED CONVERSIONS<sup>a, b, c</sup>**

$V_{ult}$	100	110	120	130	140	150	160	170	180	190	200
$V_{asd}$	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.

b.  $V_{asd}$  = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609A.1.1.

c.  $V_{ult}$  = ultimate design wind speeds determined from Figures 1609A, 1609B, or 1609C.

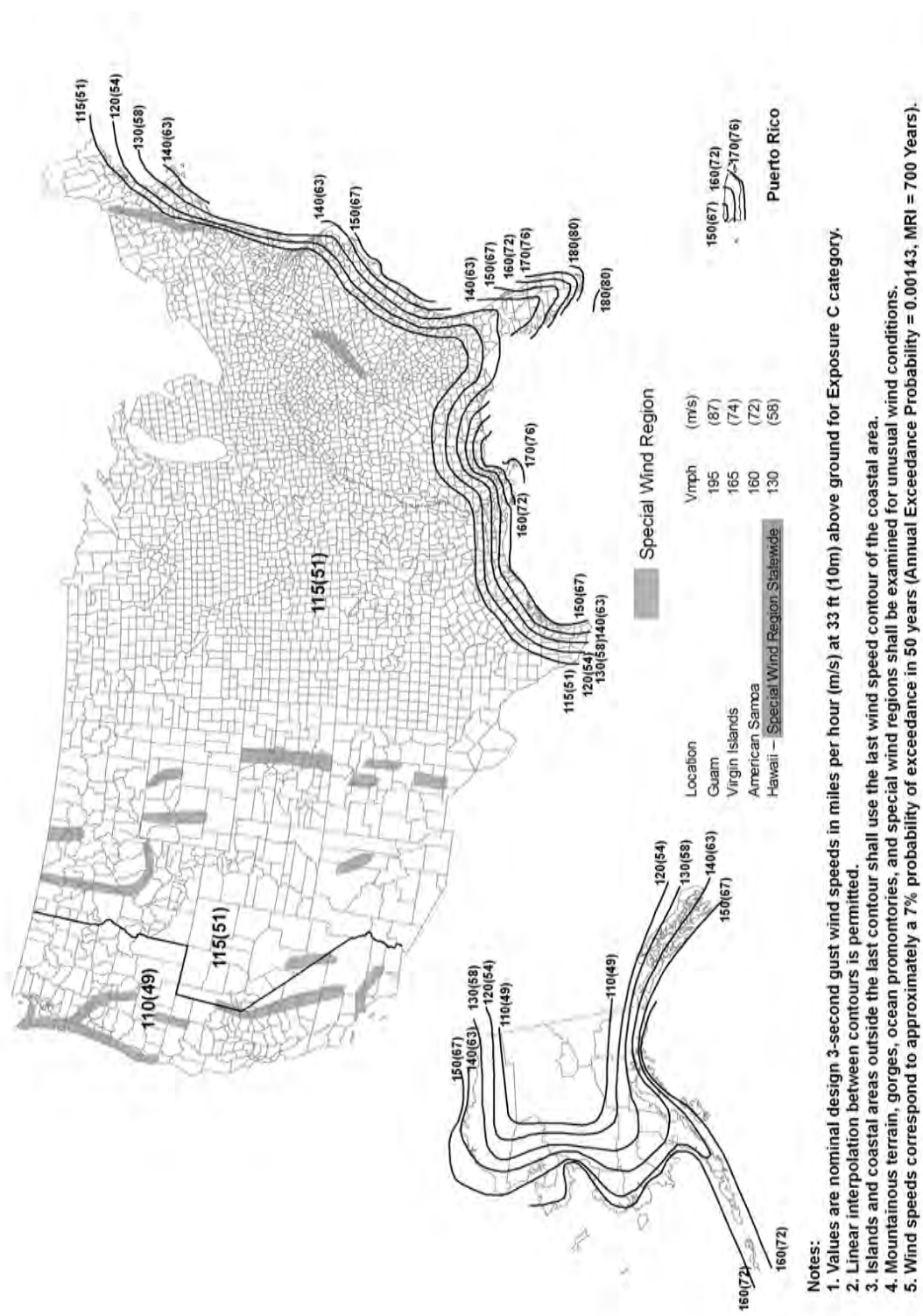


FIGURE 1609A  
ULTIMATE DESIGN WIND SPEEDS,  $V_{ULT}$ , FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES



FIGURE 1609B  
ULTIMATE DESIGN WIND SPEEDS,  $V_{ult}$ , FOR RISK CATEGORY III AND IV BUILDINGS AND OTHER STRUCTURES



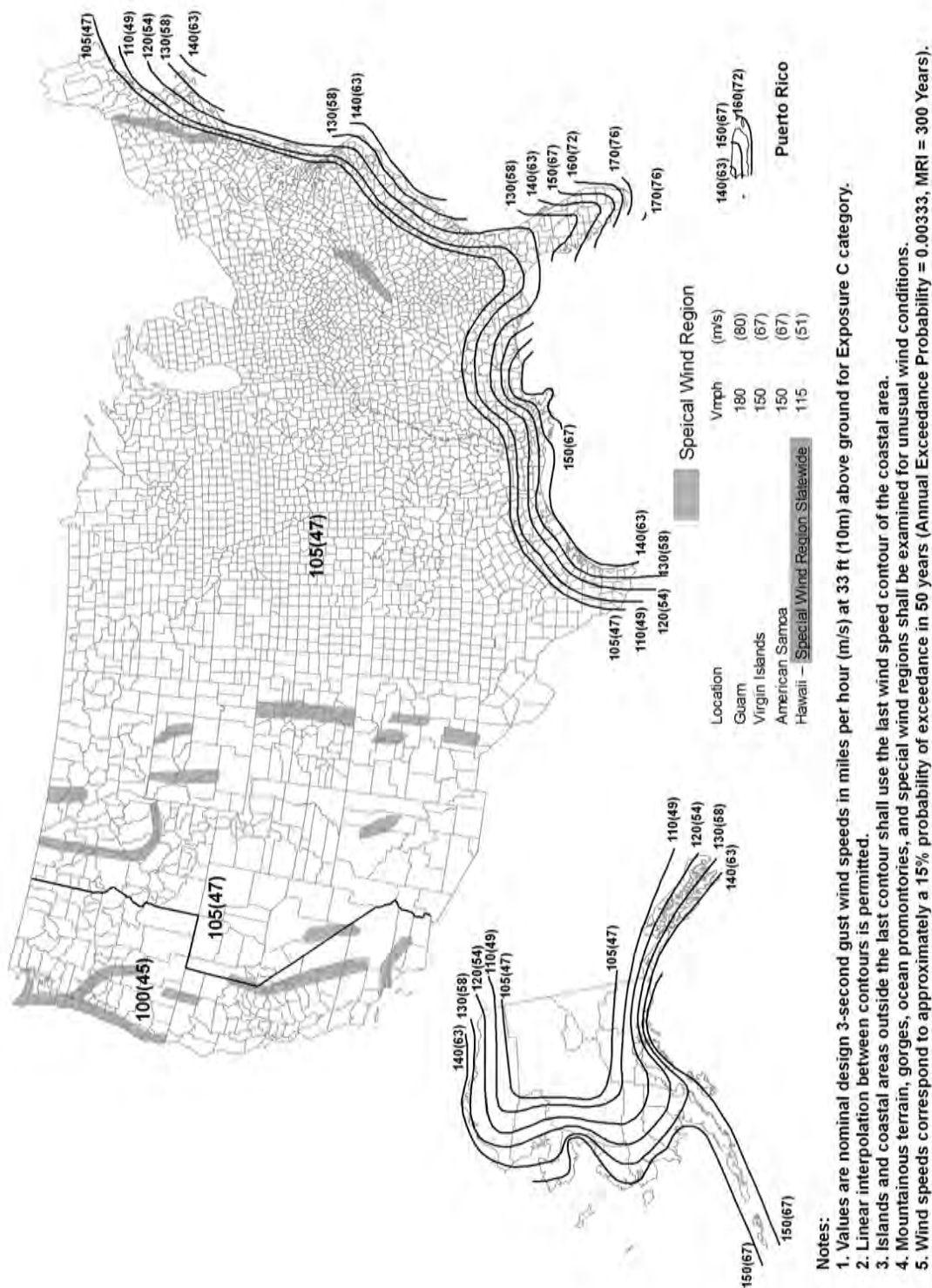


FIGURE 1609C  
ULTIMATE DESIGN WIND SPEEDS,  $V_{ULT}$ , FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES

**1609A.4.3 Exposure categories.** An exposure category shall be determined in accordance with the following:

**Exposure B.** For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

**Exposure C.** Exposure C shall apply for all cases where Exposures B or D do not apply.

**Exposure D.** Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall also apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an exposure D condition as defined in the previous sentence.

**1609A.5 Roof systems.** Roof systems shall be designed and constructed in accordance with Sections 1609A.5.1 through 1609A.5.3, as applicable.

**1609A.5.1 Roof deck.** The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

**1609A.5.2 Roof coverings.** Roof coverings shall comply with Section 1609A.5.1.

**Exception:** Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609A.5.1 are permitted to be designed in accordance with Section 1609A.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609A.5.1 shall comply with the wind-resistance requirements of Section 1507.2.7.1.

**1609A.5.3 Rigid tile.** Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - G C_p] \quad (\text{Equation 16A-34})$$

For SI:  $M_a =$

where:

$b$  = Exposed width, feet (mm) of the roof tile.

$C_L$  = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1711A.2.

$G C_p$  = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

$L$  = Length, feet (mm) of the roof tile.

$L_a$  = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at  $0.76L$  from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

$M_a$  = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

$q_h$  = Wind velocity pressure, psf ( $\text{kN/m}^2$ ) determined from Section 27.3.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing which has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have at least two-thirds of the tile's area free of mortar or adhesive contact.

**1609A.6 Alternate all-heights method.** The alternate wind design provisions in this section are simplifications of the ASCE 7 Directional Procedure.

**1609A.6.1 Scope.** As an alternative to ASCE 7 Chapters 27 and 30, the following provisions are permitted to be used to determine the wind effects on regularly shaped buildings, or other structures that are regularly shaped, which meet all of the following conditions:

1. The building or other structure is less than or equal to 75 feet (22 860 mm) in height with a height-to-least-width ratio of 4 or less, or the building or other structure has a fundamental frequency greater than or equal to 1 hertz.

2. The building or other structure is not sensitive to dynamic effects.
3. The building or other structure is not located on a site for which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.
4. The building shall meet the requirements of a simple diaphragm building as defined in ASCE 7 Section 26.2, where wind loads are only transmitted to the main windforce-resisting system (MWFRS) at the diaphragms.
5. For open buildings, multspan gable roofs, stepped roofs, sawtooth roofs, domed roofs, roofs with slopes greater than 45 degrees (0.79 rad), solid free-standing walls and solid signs, and rooftop equipment, apply ASCE 7 provisions.

**1609A.6.1.1 Modifications.** The following modifications shall be made to certain subsections in ASCE 7: in Section 1609A.6.2, symbols and notations that are specific to this section are used in conjunction with the symbols and notations in ASCE 7 Section 26.3.

**1609A.6.2 Symbols and notations.** Coefficients and variables used in the alternative all-heights method equations are as follows:

$C_{net}$  = Net-pressure coefficient based on  $K_d [(G) (C_p) - (GC_{pi})]$ , in accordance with Table 1609A.6.2.

$G$  = Gust effect factor for rigid structures in accordance with ASCE 7 Section 26.9.1.

$I$  = Importance Factor in accordance with ASCE 7 Section 6.5.5

$K_d$  = Wind directionality factor in accordance with ASCE 7 Table 26-6.

$P_{net}$  = Design wind pressure to be used in determination of wind loads on buildings or other structures or their components and cladding, in psf (kN/m<sup>2</sup>).

**1609A.6.3 Design equations.** When using the alternative all-heights method, the MWFRS, and components and cladding of every structure shall be designed to resist the effects of wind pressures on the building envelope in accordance with Equation 16A-34.

$$P_{net} = 0.00256V^2K_zC_{net}K_{zt} \quad \text{(Equation 16-35)}$$

Design wind forces for the MWFRS shall not be less than 16 psf (0.77 kN/m<sup>2</sup>) multiplied by the area of the structure projected on a plane normal to the assumed wind direction (see ASCE 7 Section 27.4.7 for criteria). Design net wind pressure for components and cladding shall not be less than 16 psf (0.77 kN/m<sup>2</sup>) acting in either direction normal to the surface.

**1609A.6.4 Design procedure.** The MWFRS and the components and cladding of every building or other structure

shall be designed for the pressures calculated using Equation 16A-35.

**1609A.6.4.1 Main wind-force-resisting systems.** The MWFRS shall be investigated for the torsional effects identified in ASCE 7 Figure 27.4.6.

**1609A.6.4.2 Determination of  $K_z$  and  $K_{zt}$ .** Velocity pressure exposure coefficient,  $K_z$ , shall be determined in accordance with ASCE 7 Section 27.3.1 and the topographic factor,  $K_{zt}$ , shall be determined in accordance with ASCE 7 Section 26-8.

1. For the windward side of a structure,  $K_{zt}$  and  $K_z$  shall be based on height  $z$ .
2. For leeward and sidewalls, and for windward and leeward roofs,  $K_{zt}$  and  $K_z$  shall be based on mean roof height  $h$ .

**1609A.6.4.3 Determination of net pressure coefficients,  $C_{net}$ .** For the design of the MWFRS and for components and cladding, the sum of the internal and external net pressure shall be based on the net pressure coefficient,  $C_{net}$ .

1. The pressure coefficient,  $C_{net}$ , for walls and roofs shall be determined from Table 1609A.6.2.
2. Where  $C_{net}$  has more than one value, the more severe wind load condition shall be used for design.

**1609A.6.4.4 Application of wind pressures.** When using the alternative all-heights method, wind pressures shall be applied simultaneously on, and in a direction normal to, all building envelope wall and roof surfaces.

**1609A.6.4.4.1 Components and cladding.** Wind pressure for each component or cladding element is applied as follows using  $C_{net}$  values based on the effective wind area,  $A$ , contained within the zones in areas of discontinuity of width and/or length “a,” “2a” or “4a” at: corners of roofs and walls; edge strips for ridges, rakes and eaves; or field areas on walls or roofs as indicated in figures in tables in ASCE 7 as referenced in Table 1609A.6.2 in accordance with the following:

1. Calculated pressures at local discontinuities acting over specific edge strips or corner boundary areas.
2. Include “field” (Zone 1, 2 or 4, as applicable) pressures applied to areas beyond the boundaries of the areas of discontinuity.
3. Where applicable, the calculated pressures at discontinuities (Zones 2 or 3) shall be combined with design pressures that apply specifically on rakes or eave overhangs.

**TABLE 1609A.6.2**  
**NET PRESSURE COEFFICIENTS,  $C_{net}^{a,b}$**

STRUCTURE OR PART THEREOF	DESCRIPTION		C <sub>net</sub> FACTOR			
1. Main windforce-resisting frames and systems	Walls:		Enclosed		Partially enclosed	
			+ Internal pressure	- Internal pressure	+ Internal pressure	- Internal pressure
			Windward wall	0.43	0.73	0.11
	Leeward wall		-0.51	-0.21	-0.83	0.11
	Sidewall		-0.66	-0.35	-0.97	-0.04
	Parapet wall	Windward	1.28		1.28	
		Leeward	-0.85		-0.85	
	Roofs:		Enclosed		Partially enclosed	
	Wind perpendicular to ridge		+ Internal pressure	- Internal pressure	+ Internal pressure	- Internal pressure
	Leeward roof or flat roof		-0.66	-0.35	-0.97	-0.04
	Windward roof slopes:					
	Slope < 2:12 (10°)	Condition 1	-1.09	-0.79	-1.41	-0.47
		Condition 2	-0.28	0.02	-0.60	0.34
	Slope = 4:12 (18°)	Condition 1	-0.73	-0.42	-1.04	-0.11
		Condition 2	-0.05	0.25	-0.37	0.57
	Slope = 5:12 (23°)	Condition 1	-0.58	-0.28	-0.90	0.04
		Condition 2	0.03	0.34	-0.29	0.65
	Slope = 6:12 (27°)	Condition 1	-0.47	-0.16	-0.78	0.15
		Condition 2	0.06	0.37	-0.25	0.68
	Slope = 7:12 (30°)	Condition 1	-0.37	-0.06	-0.68	0.25
		Condition 2	0.07	0.37	-0.25	0.69
	Slope = 9:12 (37°)	Condition 1	-0.27	0.04	-0.58	0.35
		Condition 2	0.14	0.44	-0.18	0.76
	Slope = 12:12 (45°)		0.14	0.44	-0.18	0.76
	Wind parallel to ridge and flat roofs		-1.09	-0.79	-1.41	-0.47
	Nonbuilding Structures: Chimneys, Tanks and Similar Structures:					
				h/D		
				1	7	25
	Square (Wind normal to face)			0.99	1.07	1.53
	Square (Wind on diagonal)			0.77	0.84	1.15
	Hexagonal or Octagonal			0.81	0.97	1.13
	Round			0.65	0.81	0.97
	Open signs and lattice frameworks			Ratio of solid to gross area		
				< 0.1	0.1 to 0.29	0.3 to 0.7
	Flat			1.45	1.30	1.16
Round			0.87	0.94	1.08	

(continued)

**TABLE 1609A.6.2—continued**  
**NET PRESSURE COEFFICIENTS,  $C_{net}$ <sup>a, b</sup>**

STRUCTURE OR PART THEREOF	DESCRIPTION		$C_{net}$ FACTOR	
			Enclosed	Partially enclosed
2. Components and cladding not in areas of discontinuity—roofs and overhangs	<b>Roof elements and slopes</b>		<b>Enclosed</b>	<b>Partially enclosed</b>
	Gable of hipped configurations (Zone 1)			
	Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 1			
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.00	-1.32
		100 square feet or more	-0.92	-1.23
	Overhang: Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2A Zone 1			
	Negative	10 square feet or less	-1.45	
		100 square feet or more	-1.36	
		500 square feet or more	-0.94	
	6:12 (27°) < Slope < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 1			
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.00	-1.32
		100 square feet or more	-0.83	-1.15
	Monosloped configurations (Zone 1)		<b>Enclosed</b>	<b>Partially enclosed</b>
	Flat < Slope < 7:12 (30°) See ASCE 7 Figure 30.4-5B Zone 1			
	Positive	10 square feet or less	0.49	0.81
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.26	-1.57
		100 square feet or more	-1.09	-1.40
	Tall flat-topped roofs $h > 60$ feet		<b>Enclosed</b>	<b>Partially enclosed</b>
	Flat < Slope < 2:12 (10°) (Zone 1) See ASCE 7 Figure 30.8-1 Zone 1			
	Negative	10 square feet or less	-1.34	-1.66
		500 square feet or more	-0.92	-1.23
3. Components and cladding in areas of discontinuities—roofs and overhangs (continued)	Gable or hipped configurations at ridges, eaves and rakes (Zone 2)			
	Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 2			
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.68	-2.00
		100 square feet or more	-1.17	-1.49
	Overhang for Slope Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 2			
	Negative	10 square feet or less	-1.87	
		100 square feet or more	-1.87	
	6:12 (27°) < Slope < 12:12 (45°) Figure 30.4-2C		<b>Enclosed</b>	<b>Partially enclosed</b>
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.17	-1.49
		100 square feet or more	-1.00	-1.32
	Overhang for 6:12 (27°) < Slope < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 2			
	Negative	10 square feet or less	-1.70	
		500 square feet or more	-1.53	

(continued)

**TABLE 1609A.6.2—continued**  
**NET PRESSURE COEFFICIENTS,  $C_{net}$ <sup>a, b</sup>**

STRUCTURE OR PART THEREOF	DESCRIPTION	C <sub>net</sub> FACTOR		
3. Components and cladding in areas of discontinuities—roofs and overhangs (continued)	Roof elements and slopes	Enclosed	Partially enclosed	
	Monosloped configurations at ridges, eaves and rakes (Zone 2)			
	Flat < Slope < 7:12 (30°) See ASCE 7 Figure 30.4-5B Zone 2			
	Positive	10 square feet or less	0.49	0.81
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-1.51	-1.83
		100 square feet or more	-1.43	-1.74
	Tall flat topped roofs <i>h</i> > 60 feet		Enclosed	Partially enclosed
	Flat < Slope < 2:12 (10°) (Zone 2) See ASCE 7 Figure 30.8-1 Zone 2			
	Negative	10 square feet or less	-2.11	-2.42
		500 square feet or more	-1.51	-1.83
	Gable or hipped configurations at corners (Zone 3) See ASCE 7 Figure 30.4-2B Zone 3			
	Flat < Slope < 6:12 (27°)		Enclosed	Partially enclosed
	Positive	10 square feet or less	0.58	0.89
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-2.53	-2.85
		100 square feet or more	-1.85	-2.17
	Overhang for Slope Flat < Slope < 6:12 (27°) See ASCE 7 Figure 30.4-2B Zone 3			
	Negative	10 square feet or less	-3.15	
		100 square feet or more	-2.13	
	6:12 (27°) < 12:12 (45°) See ASCE 7 Figure 30.4-2C Zone 3			
	Positive	10 square feet or less	0.92	1.23
		100 square feet or more	0.83	1.15
	Negative	10 square feet or less	-1.17	-1.49
		100 square feet or more	-1.00	-1.32
	Overhang for 6:12 (27°) < Slope < 12:12 (45°)		Enclosed	Partially enclosed
	Negative	10 square feet or less	-1.70	
		100 square feet or more	-1.53	
	Monosloped Configurations at corners (Zone 3) See ASCE 7 Figure 30.4-5B Zone 3			
	Flat < Slope < 7:12 (30°)			
	Positive	10 square feet or less	0.49	0.81
		100 square feet or more	0.41	0.72
	Negative	10 square feet or less	-2.62	-2.93
		100 square feet or more	-1.85	-2.17
	Tall flat topped roofs <i>h</i> > 60 feet		Enclosed	Partially enclosed
	Flat < Slope < 2:12 (10°) (Zone 3) See ASCE 7 Figure 30.8-1 Zone 3			
	Negative	10 square feet or less	-2.87	-3.19
		500 square feet or more	-2.11	-2.42
4. Components and cladding not in areas of discontinuity—walls and parapets (continued)	Wall Elements: <i>h</i> = 60 feet (Zone 4) Figure 30.4-1		Enclosed	Partially enclosed
	Positive	10 square feet or less	1.00	1.32
		500 square feet or more	0.75	1.06
	Negative	10 square feet or less	-1.09	-1.40
		500 square feet or more	-0.83	-1.15
	Wall Elements: <i>h</i> > 60 feet (Zone 4) See ASCE 7 Figure 30.8-1 Zone 4			
	Positive	20 square feet or less	0.92	1.23
		500 square feet or more	0.66	0.98

(continued)

**TABLE 1609A.6.2—continued**  
**NET PRESSURE COEFFICIENTS,  $C_{net}$** <sup>a, b</sup>

STRUCTURE OR PART THEREOF	DESCRIPTION		$C_{net}$ FACTOR	
4. Components and cladding not in areas of discontinuity—walls and parapets (continued)	Negative	20 square feet or less	-0.92	-1.23
		500 square feet or more	-0.75	-1.06
	Parapet Walls			
	Positive		2.87	3.19
	Negative		-1.68	-2.00
5. Components and cladding in areas of discontinuity—walls and parapets	Wall elements: $h \leq 60$ feet (Zone 5) Figure 30.4-1		<b>Enclosed</b>	<b>Partially enclosed</b>
	Positive	10 square feet or less	1.00	1.32
		500 square feet or more	0.75	1.06
	Negative	10 square feet or less	-1.34	-1.66
		500 square feet or more	-0.83	-1.15
	Wall elements: $h > 60$ feet (Zone 5) See ASCE 7 Figure 30.8-1 Zone 4			
	Positive	20 square feet or less	0.92	1.23
		500 square feet or more	0.66	0.98
	Negative	20 square feet or less	-1.68	-2.00
		500 square feet or more	-1.00	-1.32
	Parapet walls			
	Positive		3.64	3.95
	Negative		-2.45	-2.76

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929m<sup>2</sup>, 1 degree = 0.0175 rad.

a. Linear interpolation between values in the table is permitted.

b. Some  $C_{net}$  values have been grouped together. Less conservative results may be obtained by applying ASCE 7 provisions.

## SECTION 1610A SOIL LATERAL LOADS

**1610A.1 General.** Foundation walls and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610A.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803A. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils at the site are expansive. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805A.4.2 and 1805A.4.3.

**Exception:** Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

## SECTION 1611A RAIN LOADS

**1611A.1 Design rain loads.** Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is

blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow. The design rainfall shall be based on the 100-year hourly rainfall rate indicated in Figure 1611A.1 or on other rainfall rates determined from approved local weather data.

$$R = 5.2(d_s + d_h) \quad \text{(Equation 16A-36)}$$

For SI:  $R = 0.0098(d_s + d_h)$

where:

$d_h$  = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (i.e., the hydraulic head), in inches (mm).

$d_s$  = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary drainage system is blocked (i.e., the static head), in inches (mm).

$R$  = Rain load on the undeflected roof, in psf (kN/m<sub>2</sub>). When the phrase “undeflected roof” is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

**1611A.2 Ponding instability.** Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Section 8.4 of ASCE 7.

**1611A.3 Controlled drainage.** Roofs equipped with hardware to control the rate of drainage shall be equipped with a

secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611A.1. Such roofs shall also be checked for ponding instability in accordance with Section 1611A.2.

**TABLE 1610A.1  
LATERAL SOIL LOAD**

DESCRIPTION OF BACKFILL MATERIAL <sup>c</sup>	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD <sup>a</sup> (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

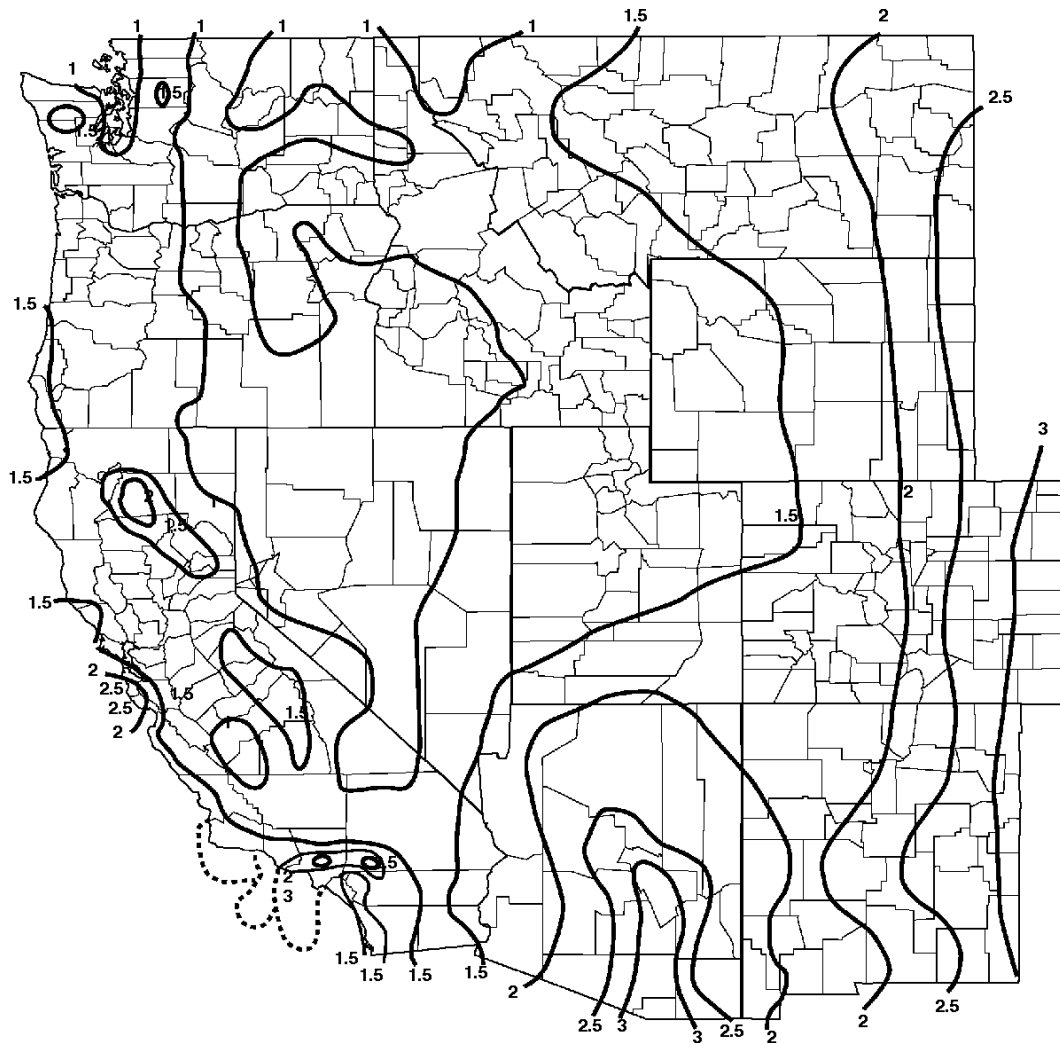
For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.

b. Unsuitable as backfill material.

c. The definition and classification of soil materials shall be in accordance with ASTM D 2487.

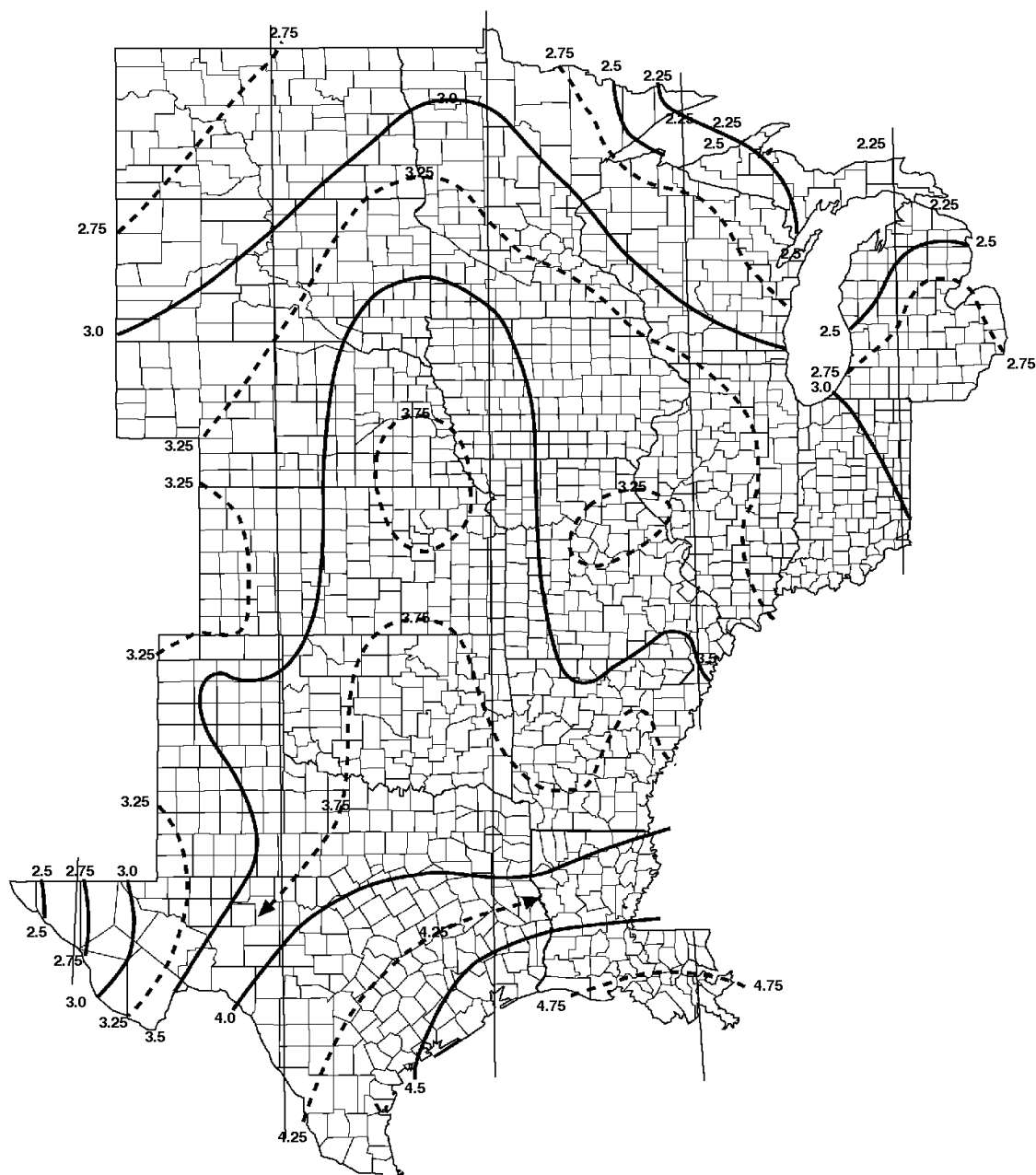




[P] FIGURE 1611A.1  
100-YEAR, 1-HOUR RAINFALL (INCHES) WESTERN UNITED STATES

For SI: 1 inch = 25.4 mm.

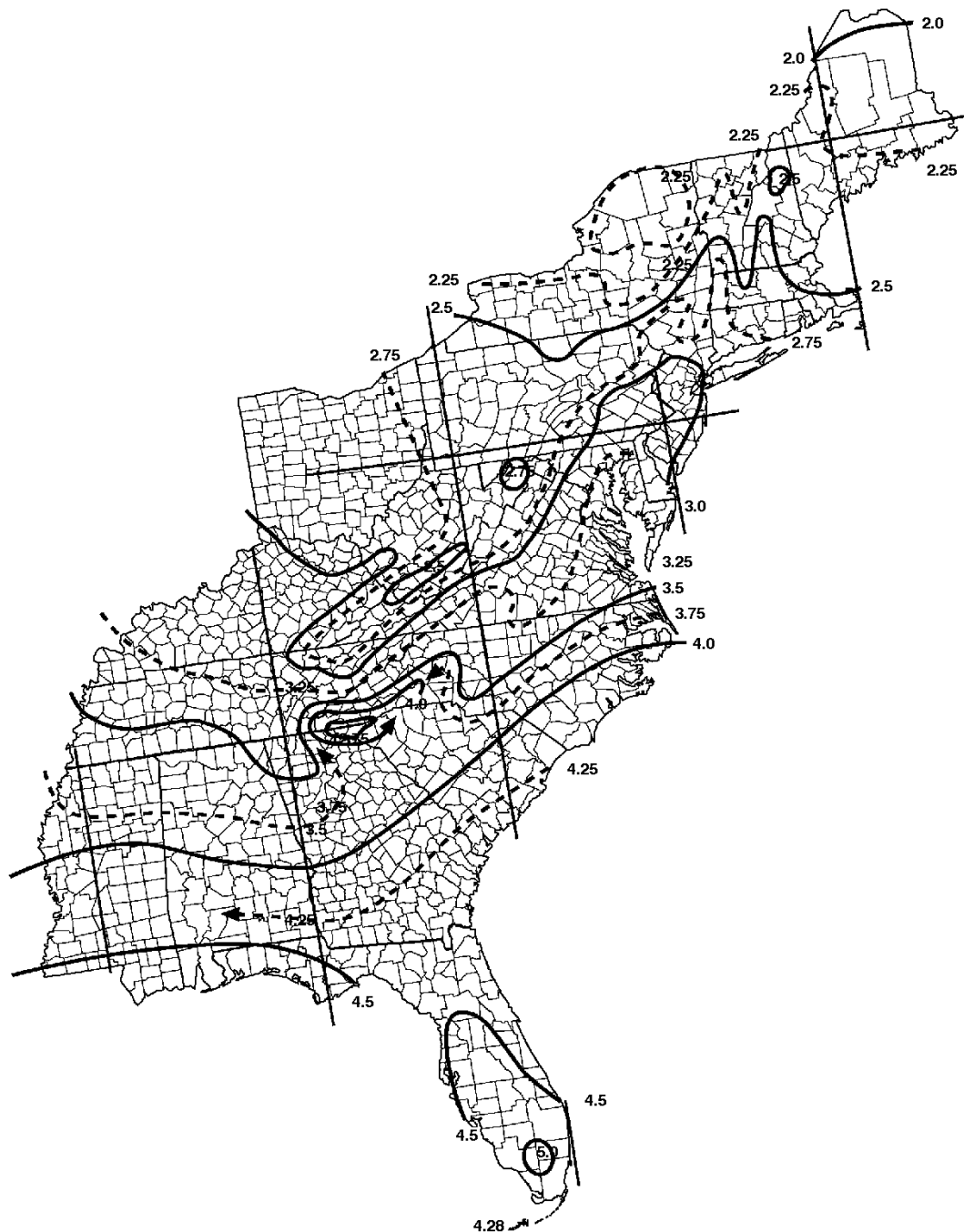
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611A.1—continued  
100-YEAR, 1-HOUR RAINFALL (INCHES) CENTRAL UNITED STATES

For SI: 1 inch = 25.4 mm.

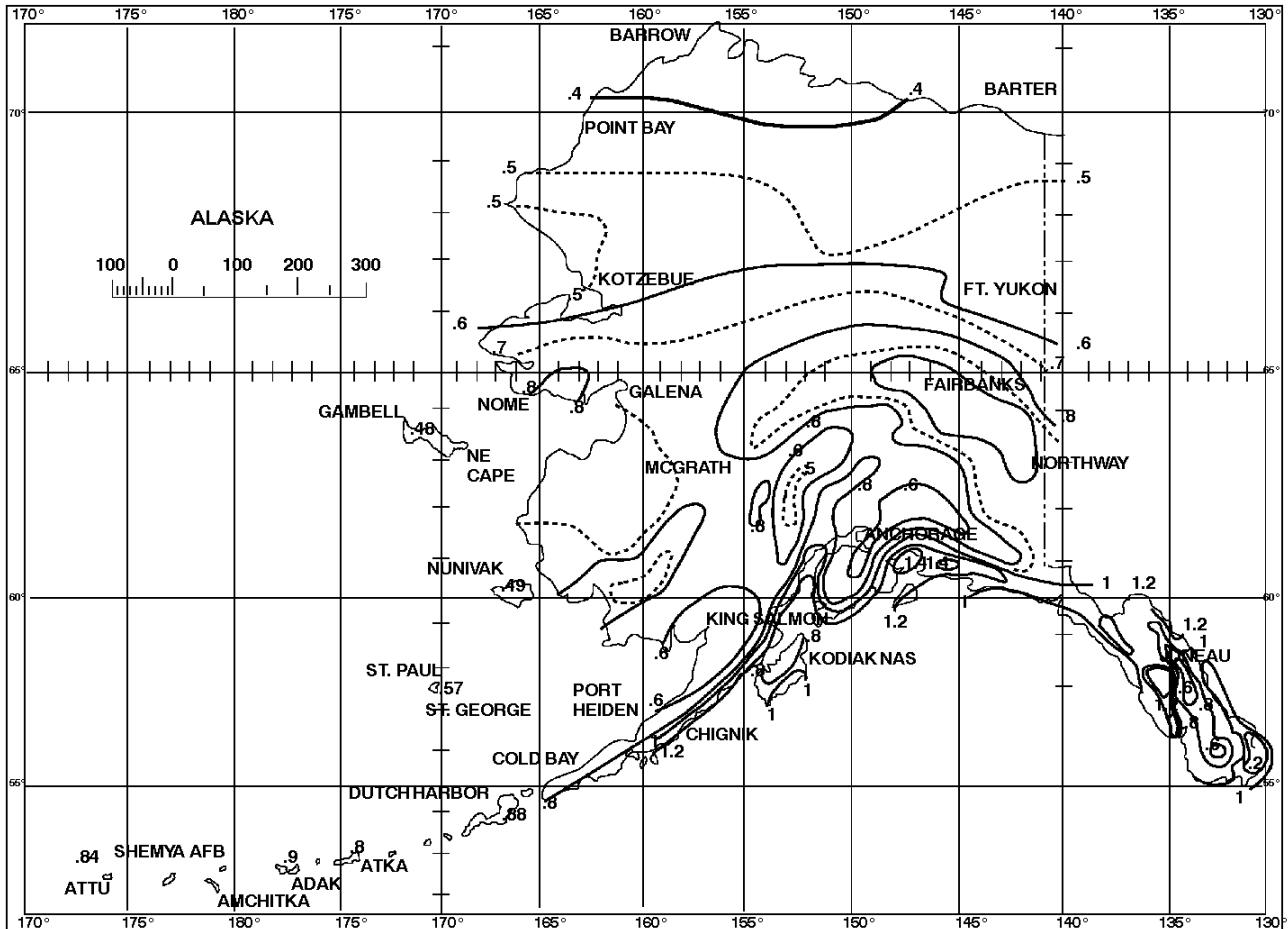
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611A.1—continued  
100-YEAR, 1-HOUR RAINFALL (INCHES) EASTERN UNITED STATES

For SI: 1 inch = 25.4 mm.

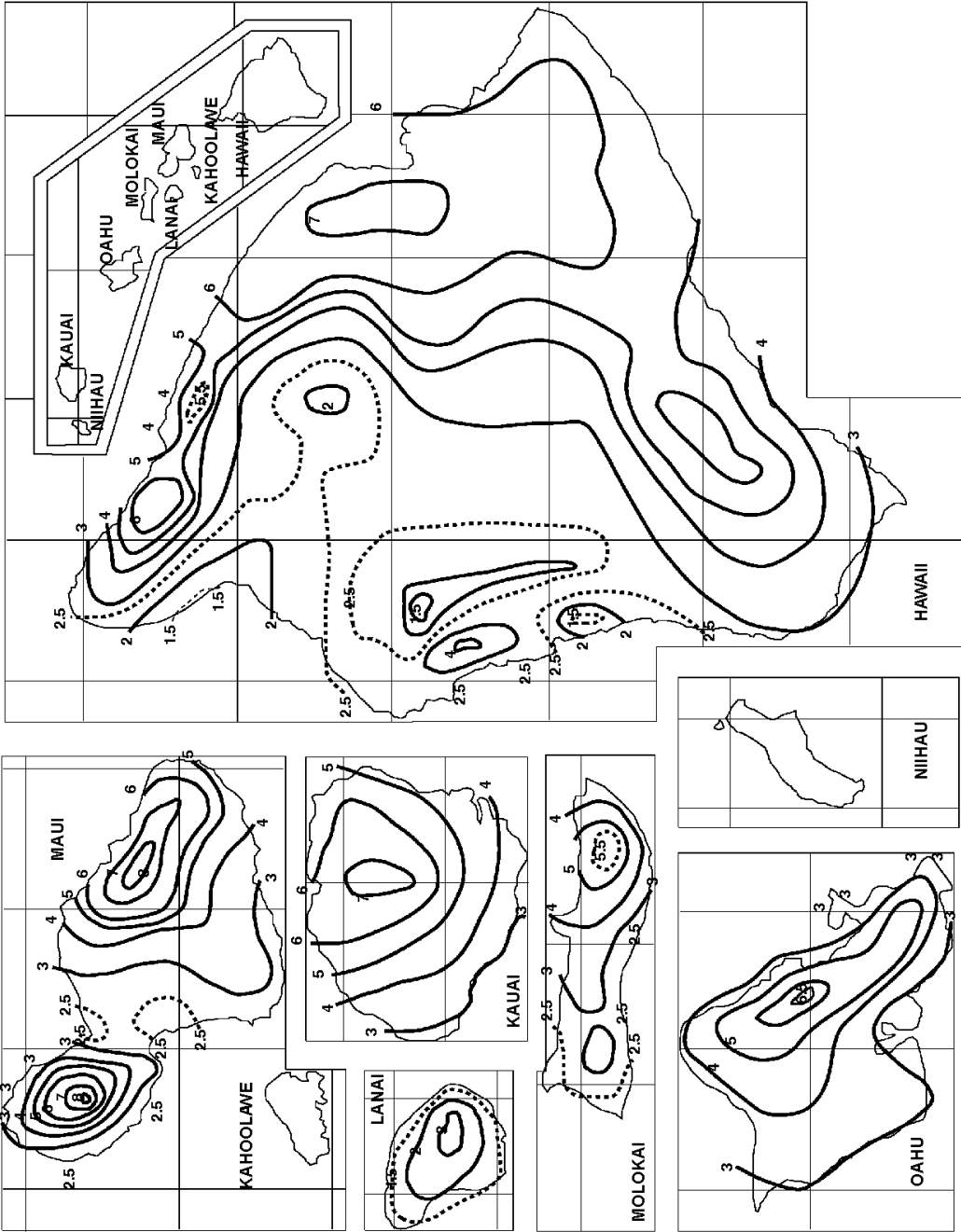
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



**[P] FIGURE 1611A.1—continued**  
**100-YEAR, 1-HOUR RAINFALL (INCHES) ALASKA**

For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.



[P] FIGURE 1611A.1—continued  
100-YEAR, 1-HOUR RAINFALL (INCHES) HAWAII

For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

## SECTION 1612A FLOOD LOADS

**1612A.1 General.** Within flood hazard areas as established in Section 1612A.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

**1612A.2 Definitions.** The following words and terms are defined in Chapter 2.

**BASE FLOOD.**

**BASE FLOOD ELEVATION.**

**BASEMENT.**

**DESIGN FLOOD.**

**DESIGN FLOOD ELEVATION.**

**DRY FLOODPROOFING.**

**EXISTING CONSTRUCTION.**

**EXISTING STRUCTURE.**

**FLOOD or FLOODING.**

**FLOOD DAMAGE-RESISTANT MATERIALS.**

**FLOOD HAZARD AREA.**

**FLOOD HAZARD AREA SUBJECT TO HIGH-VELOCITY WAVE ACTION.**

**FLOOD INSURANCE RATE MAP (FIRM).**

**FLOOD INSURANCE STUDY.**

**FLOODWAY.**

**LOWEST FLOOR.**

**SPECIAL FLOOD HAZARD AREA.**

**START OF CONSTRUCTION.**

**SUBSTANTIAL DAMAGE.**

**SUBSTANTIAL IMPROVEMENT.**

**1612A.3 Establishment of flood hazard areas.** To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's *Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located*, as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

**1612A.3.1 Design flood elevations.** Where design flood elevations are not included in the flood hazard areas established in Section 1612A.3, or where floodways are not designated, the building official is authorized to require the applicant to:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source; or
2. Determine the design flood elevation and/or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

**1612A.3.2 Determination of impacts.** In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

**1612A.4 Design and construction.** The design and construction of buildings and structures located in flood hazard areas, including flood hazard areas subject to high-velocity wave action, shall be in accordance with Chapter 5 of ASCE 7 and with ASCE 24.

**1612A.5 Flood hazard documentation.** The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas not subject to high-velocity wave action:
  - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3.
  - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.6.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.6.2.2 of ASCE 24.
  - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.
2. For construction in flood hazard areas subject to high-velocity wave action:
  - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3.
  - 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16A.

- 2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m<sup>2</sup>) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

## SECTION 1613A EARTHQUAKE LOADS

**1613A.1 Scope.** Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7 *with all the modifications incorporated herein*, excluding Chapter 14 and Appendix 11A. The seismic design category for a structure shall be determined in accordance with Section 1613A.

**Exception:** Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

**1613A.2 Definitions.** The following terms are defined in Chapter 2, *except those defined below which shall, for the purposes of this section, have the meanings shown herein. Definition provided in Section 3402A.1 and ASCE 7 Section 11.2 shall apply when appropriate in addition to terms defined in this section.*

**ACTIVE EARTHQUAKE FAULT.** A fault that has been the source of earthquakes or is recognized as a potential source of earthquakes, including those that have exhibited surface displacement within Holocene time (about 11,000 years) as determined by California Geological Survey (CGS) under the Alquist-Priolo Earthquake Fault Zoning Act, those included as type A or type B faults for the U.S. Geological Survey (USGS) National Seismic Hazard Maps, and faults considered to have been active in Holocene time by any authoritative source, federal, state or local governmental agency.

**BASE.** The level at which the horizontal seismic ground motions are considered to be imparted to the structure or the level at which the structure as a dynamic vibrator is supported. This level does not necessarily coincide with the ground level.

### DESIGN EARTHQUAKE GROUND MOTION.

**DISTANCE FROM AN ACTIVE EARTHQUAKE FAULT.** Distance measured from the nearest point of the building to the closest edge of an Alquist-Priolo Earthquake Fault Zone for an active fault, if such a map exists, or to the closest mapped splay of the fault.

**GENERAL ACUTE CARE HOSPITAL.** See Section 1224.3.  
**HOSPITAL BUILDINGS.** Hospital buildings and all other medical facilities as defined in Section 1250, Health and Safety Code.

**IRREGULAR STRUCTURE.** A structure designed as having one or more plan or vertical irregularities per ASCE 7 Section 12.3.

### MECHANICAL SYSTEMS.

#### ORTHOGONAL.

### RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE<sub>R</sub>) GROUND MOTION RESPONSE ACCELERATION.

### SEISMIC DESIGN CATEGORY.

### SEISMIC FORCE-RESISTING SYSTEM.

### SITE CLASS.

### SITE COEFFICIENTS.

**STRUCTURAL ELEMENTS.** Floor or roof diaphragms, decking, joists, slabs, beams or girders, columns, bearing walls, retaining walls, masonry or concrete nonbearing walls exceeding one story in height, foundations, shear walls or other lateral-force-resisting members and any other elements necessary to the vertical and lateral strength or stability of either the building as a whole or any of its parts, including connection between such elements.

**1613A.3 Seismic ground motion values.** Seismic ground motion values shall be determined in accordance with this section.

**1613A.3.1 Mapped acceleration parameters.** The parameters  $S_s$  and  $S_1$  shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures 1613.3.1(1) through 1613.3.1(6).

**1613A.3.2 Site class definitions.** Based on the site soil properties, the site shall be classified as Site Class A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7. Where the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines Site Class E or F soils are present at the site.

**1613A.3.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters.** The maximum considered earthquake spectral response acceleration for short periods,  $S_{MS}$ , and at 1-second period,  $S_{M1}$ , adjusted for site class effects shall be determined by Equations 16A-37 and 16A-38, respectively:

$$S_{MS} = F_a S_s \quad \text{(Equation 16A-37)}$$

$$S_{M1} = F_v S_1 \quad \text{(Equation 16A-38)}$$

where:

$F_a$  = Site coefficient defined in Table 1613A.3.3(1).

$F_v$  = Site coefficient defined in Table 1613A.3.3(2).

$S_s$  = The mapped spectral accelerations for short periods as determined in Section 1613A.3.1.

$S_1$  = The mapped spectral accelerations for a 1-second period as determined in Section 1613A.3.1.

**1613A.3.4 Design spectral response acceleration parameters.** Five-percent damped design spectral response acceleration at short periods,  $S_{DS}$ , and at 1-second

ond period,  $S_{D1}$ , shall be determined from Equations 16A-39 and 16A-40, respectively:

$$S_{DS} = \frac{2}{3}S_{MS} \quad (\text{Equation 16A-39})$$

$$S_{D1} = \frac{2}{3}S_{M1} \quad (\text{Equation 16A-40})$$

where:

$S_{MS}$  = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613A.3.3.

$S_{M1}$  = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613.3.3.

### 1613A.3.5 Determination of seismic design category.

Structures classified as Risk Category I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period,  $S_1$ , is greater than or equal to 0.75 shall be assigned to Seismic Design Category E. Structures classified as Risk Category IV that are located where the mapped spectral response acceleration parameter at 1-second period,  $S_1$ , is greater than or equal to 0.75 shall be assigned to Seismic Design Category F. All other structures shall be assigned to Seismic Design Category D.

#### 1613A.3.5.1 Alternative seismic design category determination. *Not permitted by DSA-SS OSHPD.*

#### 1613A.3.5.2 Simplified design procedure. *Not permitted by DSA-SS and OSHPD.*

**1613A.4 Alternatives to ASCE 7.** The provisions of Section 1613A.4 shall be permitted as alternatives to the relevant provisions of ASCE 7.

#### 1613A.4.1 Additional seismic-force-resisting systems for seismically isolated structures. Add the following exception to the end of Section 17.5.4.2 of ASCE 7:

**Exception:** For isolated structures designed in accordance with this standard, the Structural System Limitations and the Building Height Limitations in Table 12.2-1 for ordinary steel concentrically braced frames (OCBFs) as defined in Chapter 11 and *intermediate* moment frames (*IMFs*) as defined in Chapter 11 are permitted to be taken as 160 feet (48 768 mm) for structures assigned to Seismic Design Category D, E or F, provided that the following conditions are satisfied:

1. The value of  $R_1$  as defined in Chapter 17 is taken as 1.
2. For OCBFs, design is in accordance with AISC 341.
3. For IMFs, design is in accordance with AISC 341. In addition, requirements of Section E3.6e of AISC 341 shall be satisfied.

TABLE 1613A.3.3(1)  
VALUES OF SITE COEFFICIENT  $F_a$  <sup>a</sup>

SITE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT SHORT PERIOD				
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period,  $S_s$ .

b. Values shall be determined in accordance with Section 11.4.7 of ASCE 7.

TABLE 1613A.3.3(2)  
VALUES OF SITE COEFFICIENT  $F_v$  <sup>a</sup>

SITE CLASS	MAPPED SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIOD				
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 \geq 0.5$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period,  $S_1$ .

b. Values shall be determined in accordance with Section 11.4.7 of ASCE 7.



**TABLE 1613A.3.5(1)**  
**SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATIONS**

VALUE OF $S_{DS}$	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

**TABLE 1613A.3.5(2)**  
**SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION**

VALUE OF $S_{DI}$	RISK CATEGORY		
	I or II	III	IV
$S_{DI} < 0.067g$	A	A	A
$0.067g \leq S_{DI} < 0.133g$	B	B	C
$0.133g \leq S_{DI} < 0.20g$	C	C	D
$0.20g \leq S_{DI}$	D	D	D

## SECTION 1614A ATMOSPHERIC ICE LOADS

**1614A.1 General.** Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

## SECTION 1615A STRUCTURAL INTEGRITY

**1615A.1 General.** High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of this section. Frame structures shall comply with the requirements of Section 1615A.3. Bearing wall structures shall comply with the requirements of Section 1615A.4.

**1615A.2 Definitions.** The following words and terms are defined in Chapter 2, *except those defined below which shall, for the purposes of this section, have the meanings shown herein.*

### BEARING WALL STRUCTURE.

### FRAME STRUCTURE.

**HIGH-RISE BUILDING.** A building with an occupied floor located more than 75 feet (22 860 mm) above the base.

**1615A.3 Frame structures.** Frame structures shall comply with the requirements of this section.

**1615A.3.1 Concrete frame structures.** Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of ACI 318 Sections 7.13, 13.3.8.5, 13.3.8.6, 16.5, 18.12.6, 18.12.7 and 18.12.8 as applicable. Where ACI 318 requires that non-prestressed reinforcing or prestressing steel pass through

the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

**Exception:** Where concrete slabs with continuous reinforcing having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

**1615A.3.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures.** Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

**1615A.3.2.1 Columns.** Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

**1615A.3.2.2 Beams.** End connections of all beams and girders shall have a minimum nominal axial tensile

strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

**Exception:** Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than  $\frac{3}{8}$ -inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

**1615A.4 Bearing wall structures.** Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1615A.4.

**1615A.4.1 Concrete wall structures.** Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 7.13, 13.3.8.5 and 16.5 of ACI 318.

**1615A.4.2 Other bearing wall structures.** Ties in bearing wall structures other than those covered in Section 1615A.4.1 shall conform to this section.

**1615A.4.2.1 Longitudinal ties.** Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength,  $T_T$ , given by Equation 16A-41. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_T = wL_S \leq \alpha_T S \quad \text{(Equation 16A-41)}$$

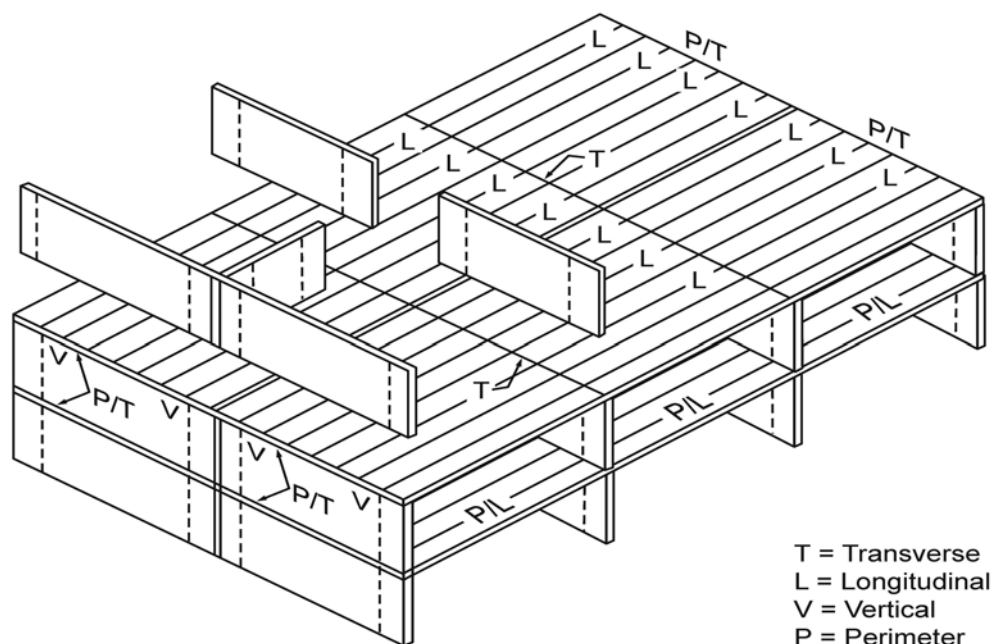
where:

$L$  = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

$w$  = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m<sup>2</sup>).

$S$  = The spacing between ties, feet (m).

$\alpha_T$  = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.



T = Transverse  
L = Longitudinal  
V = Vertical  
P = Perimeter

**FIGURE 1614A.4**  
**LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES**

**1615A.4.2.2 Transverse ties.** Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed no farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength  $T_T$ , given by Equation 16A-46. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

**1615A.4.2.3 Perimeter ties.** Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than  $T_p$ , given by Equation 16A-42. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_p = 200w \leq \beta_T \quad (\text{Equation 16A-42})$$

For SI:

$$T_p = 90.7w \leq \beta_T$$

where:

$w$  = As defined in Section 1614A.4.2.1.

$\beta_T$  = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame construction.

**1615A.4.2.4 Vertical ties.** Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. No fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

## SECTION 1616A MODIFICATIONS TO ASCE 7

**1616A.1 General.** The text of ASCE 7 shall be modified as indicated in Sections 1616A.1.1 through 1616A.1.42.

**1616A.1.1 ASCE 7, Section 1.3.** Modify ASCE 7 Section 1.3 by the adding Section 1.3.6 as follows:

**1.3.6 Structural design criteria.** Where design is based on ASCE 7, Chapters 16, 17, 18, and 31, the ground

motion, wind tunnel design recommendations, analysis, and design methods, material assumptions, testing requirements, and acceptance criteria proposed by the engineer shall be submitted to the enforcement agency in the form of structural design criteria for approval.

**[DSA-SS, OSHPD 1 & 4]** Peer review requirements in Section 3414A of this code shall apply to design reviews required by ASCE 7 Chapters 17 and 18.

**1616A.1.2 ASCE 7, Section 11.1.3.** Replace last paragraph of ASCE 7, Section 11.1.3, by the following:

*Buildings shall be designed and detailed in accordance with Chapter 12.*

**1616A.1.3 ASCE 7, Section 11.4.7.** Modify ASCE 7 Section 11.4.7 by adding the following:

*For buildings assigned to Seismic Design Category E or F, or when required by the building official, a ground motion hazard analysis shall be performed in accordance with ASCE 7 Chapter 21 as modified by Section 1803A.6 of this code.*

**1616A.1.4 ASCE 7, Table 12.2-1.** Modify ASCE 7 Table 12.2-1 as follows:

### A. BEARING WALL SYSTEMS

5. *Intermediate Precast Shear Walls—Not permitted by OSHPD.*

17. *Light-framed walls with shear panels of all other materials—Not permitted by OSHPD and DSA-SS.*

### B. BUILDING FRAME SYSTEMS

3. *Ordinary steel concentrically braced frames—Not permitted by OSHPD.*

8. *Intermediate Precast Shear Walls—Not permitted by OSHPD.*

24. *Light-framed walls with shear panels of all other materials—Not permitted by OSHPD and DSA-SS.*

26. *Special steel plate shear wall—Not permitted by OSHPD.*

### C. MOMENT-RESISTING FRAME SYSTEMS

2. *Special steel truss moment frames—Not permitted by OSHPD.*

3. *Intermediate steel moment frames—Not permitted by OSHPD.*

4. *Ordinary steel moment frames—Not permitted by OSHPD.*

5. *Cold-formed steel—special bolted moment frame - Not permitted by DSA-SS and OSHPD.*

### Exceptions:

1. *Systems listed in this section can be used as an alternative system when preapproved by the enforcement agency.*

2. *Rooftop or other supported structures not exceeding two stories in height and 10 percent of*

the total structure weight can use the systems in this section when designed as components per ASCE 7 Chapter 13.

3. Systems listed in this section can be used for seismically isolated buildings when permitted by Section 1613A.4.1.

**1616A.1.5 ASCE 7, Section 12.2.3.1.** Replace ASCE 7, Section 12.2.3.1, Items 1 and 2, by the following:

The value of the response modification coefficient,  $R$ , used for design at any story shall not exceed the lowest value of  $R$  that is used in the same direction at any story above that story. Likewise, the deflection amplification factor,  $C_d$ , and the system over strength factor,  $\Omega_0$ , used for the design at any story shall not be less than the largest value of these factors that are used in the same direction at any story above that story.

**1616A.1.6 ASCE 7, Section 12.2.3.2.** Modify ASCE 7, Section 12.2.3.2, by adding the following additional requirements:

- f. Where design of elements of the upper portion is governed by special seismic load combinations, the special loads shall be considered in the design of the lower portion.

**1616A.1.7 ASCE 7, Section 12.2.5.6.1 [DSA-SS]** The exception after the first paragraph is not permitted by DSA-SS.

**1616A.1.8 ASCE 7, Section 12.2.5.7.1 [DSA-SS]** The exception after the first paragraph is not permitted by DSA-SS.

**1616A.1.9 ASCE 7, Section 12.2.5.7.2 [DSA-SS]** The exception after the first paragraph is not permitted by DSA-SS.

**1616A.1.10 ASCE 7, Section 12.3.3.** Modify first sentence of ASCE 7, Section 12.3.3.1, as follows:

**12.3.3.1 Prohibited horizontal and vertical irregularities for Seismic Design Categories D through F.** Structures assigned to Seismic Design Category D, E or F having horizontal structural irregularity Type 1b of Table 12.3-1 or vertical structural irregularities Type 1b, 5a or 5b of Table 12.3-2 shall not be permitted.

**1615A.1.11 ASCE 7, Section 12.7.2.** Modify ASCE 7, Section 12.7.2, by adding Item 6 to read as follows:

6. Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a geotechnical engineer qualified in soils engineering plus the difference in earth pressures shall be added to the lateral forces provided in this section.

**1616A.1.12 ASCE 7, Section 12.8.1.3.** Replace ASCE 7, Section 12.8.1.3, by the following:

**12.8.1.3 Maximum  $S_s$  value in determination of  $C_s$ .**  
For regular structures five stories or less above the

base, as defined in Section 11.2, and with a period,  $T$ , of 0.5 s or less,  $C_s$  is permitted to be calculated using the larger of either  $S_s = 1.5$  or 80 percent of the value of  $S_s$  determined per Sections 11.4.1 or 11.4.7.

**1616A.1.13 ASCE 7, Section 12.9.4.** Replace ASCE 7 Section 12.9.4 as follows:

**12.9.4 Scaling design values of combined response.** Modal base shears used to determine forces and drifts shall not be less than the base shear calculated using the equivalent lateral force procedure of Section 12.8.

**1616A.1.14 ASCE 7, Section 12.10.2.1.** Replace ASCE 7, Exception 1 of Section 12.10.2.1, by adding the following:

**Exception:**

1. The forces calculated above need not exceed those calculated using the load combinations of Section 12.4.3.2 with seismic forces determined by Equation 12.10-3 and transfer forces, where applicable.

**1616A.1.15 ASCE 7, Section 12.12.3. [OSHDP 1 & 4]** Replace ASCE 7 Equation 12.12-1 by the following:

$$\delta_M = C_d \delta_{\max} \quad (\text{Equation 12.12-1})$$

**1616A.1.16 ASCE 7, Section 12.13.1.** Modify ASCE 7 Section 12.13.1 by adding Section 12.13.1.1 as follows:

**12.13.1.1 Foundations and superstructure-to-foundation connections.** The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605A.1.1.

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. The strength of the superstructure elements.
2. The maximum forces that would occur in the fully yielded structural system.
3. Forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3.2.

**Exceptions:**

1. Where referenced standards specify the use of higher design loads.
2. When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.
3. Where basic structural system consists of light framed walls with shear panels, unless the reference standard specifies the use of higher design loads.

Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the

modal analysis method, reduction in overturning moment permitted by section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

**1616A.1.17 ASCE 7, Section 13.1.3. [OSHPD 1 & 4]** Modify ASCE 7 Section 13.1.3 by the following:

The design of supports and attachments for all non-structural components shall have a component importance factor,  $I_p$ , equal to 1.5.

**1616A.1.18 ASCE 7, Section 13.1.4.** Replace ASCE 7, Section 13.1.4, with the following:

**13.1.4 Exemptions.** The following nonstructural components are exempt from the requirements of this section:

1. Furniture (except storage cabinets as noted in Table 13.5-1).
2. Temporary or moveable (mobile) equipment.

**Exceptions:**

- a) Equipment shall be anchored if it is permanently attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "permanently attached" shall include all electrical connections except plugs for duplex receptacles.
- b) The enforcement agency shall be permitted to require temporary attachments for movable equipment which is usually stationed in one place and heavier than 400 pounds, when they are not in use for a period longer than 8 hours at a time.
3. Architectural, mechanical and electrical components in Seismic Design Categories D, E or F where all of the following apply:
  - a. The component is positively attached to the structure;
  - b. Flexible connections are provided at seismic separation joints and between the component and associated ductwork, piping and conduit; and either:
    - i. The component weighs 400 pounds (1780 N) or less and has a center of mass located 4 feet (1.22 m) or less above the adjacent floor or roof level that directly support the component;

**Exception:** Special Seismic Certification requirements of this code in accordance with Section 1705A.12.3 shall be applicable.

or

- ii. The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 lb/ft (73 N/m) or less.

**Exception:** The enforcement agency shall be permitted to require attachments for equipment with hazardous contents to be shown on construction documents irrespective of weight.

**1616A.1.19 ASCE 7, Section 13.4** Replace ASCE 7, Sections 13.4.2.3, with the following:

**13.4.2.3 Post-installed anchors in concrete and masonry.**

Post-installed anchors in concrete used for component anchorage shall be pre-qualified for seismic applications in accordance with ACI 355.2, ICC-ES AC193 or ICC-ES AC308. Post-installed anchors in masonry used for component anchorage shall be pre-qualified for seismic applications in accordance with ICC-ES AC01, AC58 or AC106.

Use of screw anchors shall be limited to dry interior conditions. Re-use of screw anchors or screw anchor holes shall not be permitted.

**1616A.1.20 ASCE 7, Section 13.5.6.** Replace ASCE 7, Section 13.5.6 with the following:

**13.5.6 Suspended ceilings.** Suspended ceilings shall be in accordance with this section.

**13.5.6.1 Seismic forces.** The weight of the ceiling,  $W_p$ , shall include the ceiling grid; ceiling tiles or panels; light fixtures if attached to, clipped to, or laterally supported by the ceiling grid; and other components that are laterally supported by the ceiling.  $W_p$  shall be taken as not less than 4 psf (19 N/m<sup>2</sup>).

The seismic force,  $F_p$ , shall be transmitted through the ceiling attachments to the building structural elements or the ceiling-structure boundary.

**13.5.6.2 Seismic design requirements.** Suspended acoustical tile or lay-in panel ceilings shall be designed in accordance with ASTM E 580, Section 5.2.8, and the requirements of Sections 13.5.6.2.1 and 13.5.6.2.2, or be designed in accordance with Section 13.2.1.(1), or be seismically qualified in accordance with Sections 13.2.5 or 13.2.6.

**13.5.6.2.1 Industry standard construction for acoustical tile or lay-in panel ceilings.** Acoustical tile or lay-in panel ceilings in Seismic Design Categories D, E, and F shall be designed and installed in accordance with ASTM C 635, ASTM C 636, and ASTM E 580, Section 5 - Seismic Design Categories D, E, and F as modified by Section 13.5.6.2.2.

**13.5.6.2.2 Modification to ASTM E 580.** Modify ASTM E 580 by the following:

1. **Exitways.** Lay-in ceiling assemblies in exitways of hospitals and essential services build-

ings shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors.

2. **Corridors and lobbies.** Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.
3. **Lay-in panels.** Metal panels and panels weighing more than  $1\frac{1}{2}$  pounds per square foot ( $24 \text{ N/m}^2$ ) other than acoustical tiles shall be positively attached to the ceiling suspension runners.
4. **Lateral force bracing.** Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E 580, Sections 5.2.2 and 5.2.3, are provided and perimeter walls are designed to carry the ceiling lateral forces. Restraint wires shall be secured with four tight twists in  $1\frac{1}{2}$  inches, or an approved alternate connection.
5. **Ceiling fixtures.** Fixtures installed in acoustical tile or lay-in panel ceilings shall be mounted in a manner that will not compromise ceiling performance.

All recessed or drop-in light fixtures and grilles shall be supported directly from the fixture housing to the structure above with a minimum of two 12 gage wires located at diagonally opposite corners. Leveling and positioning of fixtures may be provided by the ceiling grid. Fixture support wires may be slightly loose to allow the fixture to seat in the grid system. Fixtures shall not be supported from main runners or cross runners if the weight of the fixtures causes the total dead load to exceed the deflection capability of the ceiling suspension system.

Fixtures shall not be installed so that the main runners or cross runners will be eccentrically loaded.

Surface-mounted fixtures shall be attached to the main runner with at least two positive clamping devices made of material with a minimum of 14 gage. Rotational spring catches do not comply. A 12 gage suspension wire shall be attached to each clamping device and to the structure above.

6. **Partitions.** Where the suspended ceiling system is required to provide lateral support for the permanent or relocatable partitions, the connection of the partition to the ceiling system, the ceiling system members and their connections, and the lateral force bracing shall be designed to support the reaction force of the partition from prescribed loads applied perpendicular to the face of the partition. Partition connectors, the suspended ceiling system and the lateral-force bracing shall all be engineered to suit the individual partition application and shall be shown or defined in the drawings or specifications.

**1616A.1.21 ASCE 7, Section 13.5.7. [OSHPD 1 & 4]**  
Modify ASCE 7, Section 13.5.7, by the following:

All access floors shall be special access floors in accordance with Section 13.5.7.2.

**1616A.1.22 Reserved.**

**1616A.1.23 ASCE 7, Section 13.6.5.** Modify ASCE 7, Section 13.6.5.6, Exceptions 1 and 2, as follows:

**Exceptions:**

1. Design for the seismic forces of Section 13.3 shall not be required for raceways where either:

a. Trapeze assemblies are used to support raceways and the total weight of the raceway supported by trapeze assemblies is less than 10 lb/ft (146 N/m), or

b. The raceway is supported by hangers and each hanger in the raceway run is 12 in. (305 mm) or less in length from the raceway support point to the supporting structure. Where rod hangers are used with a diameter greater than  $\frac{3}{8}$  inch, they shall be equipped with swivels to prevent inelastic bending in the rod.

2. Design for the seismic forces of Section 13.3 shall not be required for conduit, regardless of the value of  $I_p$ , where the conduit is up to 2.5 in. (64 mm) trade size.

**1616A.1.24 ASCE 7, Section 13.6.7.** Replace ASCE 7, Section 13.6.7, Exceptions 1 and 2, with the following:

**Exceptions:**

The following exceptions pertain to ductwork not designed to carry toxic, highly toxic, or flammable gases or used for smoke control:

1. Design for the seismic forces of Section 13.3 shall not be required for ductwork where either:

a. Trapeze assemblies are used to support ductwork and the total weight of the ductwork supported by trapeze assemblies is less than 10 lb/ft (146 N/m); or

b. The ductwork is supported by hangers and each hanger in the duct run is 12 in. (305 mm) or less in length from the duct support point to the supporting structure. Where rod hangers are used with a diameter greater than  $\frac{3}{8}$  inch, they shall be equipped with swivels to prevent inelastic bending in the rod.

2. Design for the seismic forces of Section 13.3 shall not be required where provisions are made to avoid impact with larger ducts or mechanical components or to protect the ducts in the event of such impact; and HVAC ducts have a cross-sectional area of 6 ft<sup>2</sup> (0.557 m<sup>2</sup>) or less, or weigh 10 lb/ft (146 N/m) or less.

**1616A.1.25 ASCE 7, Section 13.6.8.2.** Modify ASCE 7, Section 13.6.8.2 by adding exception as follows:

**Exception:** Anchor capacities shall be determined in accordance with material chapters of this code in lieu of using those in NFPA 13 and demand shall be based on ASCE 7.

**1616A.1.26 ASCE 7, Section 13.6.8.3.** Replace ASCE 7, Section 13.6.8.3 with the following:

**13.6.8.3 Exceptions.** Design of piping systems and attachments for the seismic forces of Section 13.3 shall not be required where one of the following conditions apply:

1. Trapeze assemblies are used to support piping whereby no single pipe exceeds the limits set forth in 3a. or b. below and the total weight of the piping supported by the trapeze assemblies is less than 10 lb/ft (146 N/m).
2. The piping is supported by hangers and each hanger in the piping run is 12 in. (305 mm) or less in length from the top of the pipe to the supporting structure. Where pipes are supported on a trapeze, the trapeze shall be supported by hangers having a length of 12 in. (305 mm) or less. Where rod hangers are used with a diameter greater than  $\frac{3}{8}$  inch, they shall be equipped with swivels, eye nuts or other devices to prevent bending in the rod.
3. Piping having an  $R_p$  in Table 13.6-1 of 4.5 or greater is used and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact and where the following size requirements are satisfied:
  - a. For Seismic Design Categories D, E or F and values of  $I_p$  greater than one, the nominal pipe size shall be 1 inch (25 mm) or less.
  - b. For Seismic Design Categories D, E or F, where  $I_p = 1.0$  the nominal pipe size shall be 3 inches (80 mm) or less.

The exceptions above shall not apply to elevator piping.

**1616A.1.27 ASCE 7, Section 13.6.10.1.** Modify ASCE 7, Section 13.6.10.1, by adding Section 13.6.10.1.1 as follows:

**13.6.10.1.1 Elevators guide rail support.** The design of guide rail support-bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not less than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one third to the top guiding members and two thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7, Section 13.6.10.1, the minimum seismic forces shall be 0.5g acting in any horizontal direction.

**1616A.1.28 ASCE 7, Section 13.6.10.4.** Replace ASCE 7, Section 13.6.10.4, as follows:

**13.6.10.4 Retainer plates.** Retainer plates are required at the top and bottom of the car and counterweight, except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:

1. The seismic force shall be computed per the requirements of ASCE 7 Section 13.6.10.1. The minimum horizontal acceleration shall be 0.5g for all buildings.
2.  $W_p$  shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.
3. With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below:

RAIL SIZE (weight per foot of length, pounds)	WIDTH OF MACHINED SURFACE (inches)	ALLOWABLE RAIL DEFLECTION (inches)
8	1 $\frac{1}{4}$	0.20
11	1 $\frac{1}{2}$	0.30
12	1 $\frac{3}{4}$	0.40
15	1 $\frac{31}{32}$	0.50
18 $\frac{1}{2}$	1 $\frac{31}{32}$	0.50
22 $\frac{1}{2}$	2	0.50
30	2 $\frac{1}{4}$	0.50

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.

**Note:** Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.

4. Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.
5. The use of spreader brackets is allowed.

6. Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g.

**1616A.1.29 ASCE 7, Section 16.1.4.** Remove ASCE 7, Sections 16.1.4.1 and 16.1.4.2, and modify Section 16.1.4, by the following:

Maximum scaled base shears used to determine forces and drifts shall not be less than the base shear calculated using the equivalent lateral force procedure of Section 12.8.

**1616A.1.30 ASCE 7, Section 16.2.2.** Modify ASCE 7, Section 16.2.2, by adding the following:

Requirements of this section shall be deemed to be satisfied for new buildings, using acceptance criteria, in Section 16.2.4.2, by the nonlinear modeling parameters in ASCE 41.

**1616A.1.31 ASCE 7, Section 16.2.3.** Modify ASCE 7, Section 16.2.3, by adding the following:

Requirements of this section shall be deemed to be satisfied by using load combinations in Sections 12.4.2.3 and 12.4.3.2 with 25 percent of the required live loads.

**1616A.1.32 ASCE 7, Section 16.2.4.** Modify ASCE 7, Section 16.2.4, by the following:

- a) Where site is located within 3.1 miles (5 km) of an active fault at least seven ground motions shall be analyzed and response parameters shall be based on larger of the average of the maximum response with ground motions applied as follows:
  1. Each of the ground motions shall have their maximum component at the fundamental period aligned in one direction.
  2. Each of the ground motion's maximum component shall be rotated orthogonal to the previous analysis direction.
- b) Where site is located more than 3.1 miles (5 km) from an active fault at least 10 ground motions shall be analyzed. The ground motions shall be applied such that one-half shall have their maximum component aligned in one direction and the other half aligned in the orthogonal direction. The average of the maximum response of all the analyses shall be used for design.

**1616A.1.33 [OSHPD] ASCE 7, Section 16.2.4.1.** Replace ASCE 7 exception to Section 16.2.3 by the following:

Where this standard requires the consideration of the load combinations with overstrength factor of Section 12.4.3.2, average demand from MCE analysis obtained from suite of analysis in accordance with Section 16.2.4 shall be used with Immediate Occupancy (IO) acceptance criteria in Section 16.2.4.2.

**1616A.1.34 ASCE 7, Section 16.2.4.2 [OSHPD 1 & 4]** Modify ASCE 7, Section 16.2.4.2, by the following:

Acceptance criteria for elements subjected to deformation beyond their linear range of response shall be based

on ASCE 41 for Immediate Occupancy (IO) at Design Earthquake (DE) and Life Safety (LS) at Maximum Considered Earthquake (MCE). For LS acceptance criteria at MCE, primary components shall be within the acceptance criteria for primary components and secondary components shall be within the acceptance criteria for secondary components.

**1616A.1.35 ASCE 7, Section 17.2.1.** Modify ASCE 7, Section 17.2.1, by adding the following:

The importance factor,  $I_p$ , for parts and portions of a seismically isolated building shall be the same as that required for a fixed-base building of the same risk category.

**1616A.1.36 ASCE 7, Section 17.2.4.7.** Modify ASCE 7, Section 17.2.4.7, by adding the following:

The effects of uplift and/or rocking shall be explicitly accounted for in the analysis and in the testing of the isolator units.

**1616A.1.37 ASCE 7, Section 17.2.5.2.** Modify ASCE 7, Section 17.2.5.2, by adding the following:

The separation requirements for the building above the isolation system and adjacent buildings shall be the sum of the factored displacements for each building. The factors to be used in determining separations shall be:

1. For seismically isolated buildings, the deformation resulting from the analyses using the maximum considered earthquake unmodified by  $R_p$ .
2. For fixed based buildings,  $C_d$  times the elastic deformations resulting from an equivalent static analysis using the seismic base shear computed via ASCE 7, Section 12.8.

**1616A.1.38 ASCE 7, Section 17.4.** Modify ASCE 7, Section 17.4.2, by adding the following:

**17.4.2.3 Linear procedures.** Linear procedures shall be limited to structures located at sites with  $S_1$  less than 0.6g.

**1616A.1.39 ASCE 7, Section 17.6** Modify ASCE 7, Section 17.6, by the following:

**17.6.1.1 Minimum seismic force.** For the response spectrum and linear response history procedures,  $V_b$  and  $V_s$  shall not be taken less than those calculated in accordance with Equations 17.5-7 and 17.5-8.

**1616A.1.40 ASCE 7, Section 18.3.1.** Modify ASCE 7, Section 18.3.1, by replacing the third paragraph with the following:

If the calculated force in an element of the seismic force resisting system does not exceed 1.5 times its nominal strength for the Risk-Targeted Maximum Considered Earthquake ( $MCE_R$ ) nor its nominal strength for the design earthquake (DE), the element is permitted to be modeled as linear. For this section, the  $MCE_R$  and DE response shall be based on largest response due to a single ground motion and not the average response of suite of ground motions.



**1616A.1.41 Earthquake motion measuring instrumentation and monitoring.** [OSHPD 1 & 4] Modify ASCE 7 by the following:

**Scope:** For buildings with a seismic isolation system, a damping system or a lateral force resisting system (LFRS) not listed in ASCE 7 Table 12.2-1, earthquake motion measuring instrumentation and monitoring shall be required. Monitoring requirements shall also apply to welded steel moment frame buildings constructed under a permit issued prior to October 25, 1994.

**Instrumentation:** There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent. A proposal for instrumentation and equipment specifications shall be forwarded to the enforcement agency for review and approval. The owner of the building shall be responsible for the implementation of the instrumentation program. Maintenance of the instrumentation and removal/processing of the records shall be the responsibility of the enforcement agency.

The instruments shall be interconnected for common start and common timing. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating "MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT" shall be posted in a conspicuous location.

**Monitoring:** After every significant seismic events, where the ground shaking acceleration at the site exceeds 0.3g, or the acceleration at any monitored building level exceeds 0.8g, as measured by the seismic monitoring system in the building, the owner shall retain a structural engineer to make an inspection of the structural system. The inspection shall include viewing the performance of the building, reviewing the strong motion records, and a visual examination of the isolators, dampers and connections for deterioration, offset or physical damage. A report for each inspection, including conclusions on the continuing adequacy of the structural system, shall be submitted to the enforcement agency.

**1616A.1.42 Operational nonstructural performance level requirements.** [OSHPD 1 & 4] New general acute care hospitals and new building(s) required for general acute care services shall satisfy Operational Nonstructural Performance Level (NPC-5) requirements.

**Exception:** A new building which is required for general acute care services that is added to an existing general acute care hospital and which has a building area of 4,000 square feet (371 m<sup>2</sup>) or less, need not satisfy the NPC-5 requirements until the deadline specified in California Administrative Code (Part 1, Title 24 CCR), Chapter 6.

Hospitals and buildings designed and constructed to the provisions of this code for new construction shall be

deemed to satisfy Operational Nonstructural Performance Level (NPC-5) requirements when:

1. The facility has on-site supplies of water and holding tanks for sewage and liquid waste, sufficient to support 72 hours of emergency operations for the hospital or building, which are integrated into the building plumbing systems in accordance with the California Plumbing Code.
2. An on-site emergency system as defined in the California Electrical Code is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.

Emergency and standby generators shall not be located below the higher of the Design Flood Elevation (DFE) or Base Flood Elevation (BFE) plus two feet (BFE + 2 ft.) and shall be located at an elevation close to grade for easy accessibility from outside for maintenance.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 17 – STRUCTURAL TESTS AND SPECIAL INSPECTIONS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>											X									
<i>Adopt entire chapter as amended (amended sections listed below)</i>	X		X	X						X										
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
1702 - Approved agency			X	X																
1704.2			X	X						X										
1704.2.3	X																			
1705.5.3										X										
1707.1	X		X	X																



## CHAPTER 17

# STRUCTURAL TESTS AND SPECIAL INSPECTIONS

### SECTION 1701 GENERAL

**1701.1 Scope.** The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

**1701.2 New materials.** New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

**1701.3 Used materials.** The use of second-hand materials that meet the minimum requirements of this code for new materials shall be permitted.

### SECTION 1702 DEFINITIONS

**1702.1 Definitions.** The following terms are defined in Chapter 2:

**APPROVED AGENCY.** [HCD 1 & HCD 2] “Approved agency” shall mean “Listing agency” and “Testing agency” (See Chapter 2 definitions).

**APPROVED FABRICATOR.**

**CERTIFICATE OF COMPLIANCE.**

**DESIGNATED SEISMIC SYSTEM.**

**FABRICATED ITEM.**

**INSPECTION CERTIFICATE.**

**INTUMESCENT FIRE-RESISTANT COATINGS.**

**MAIN WINDFORCE-RESISTING SYSTEM.**

**MASTIC FIRE-RESISTANT COATINGS.**

**SPECIAL INSPECTION.**

Continuous special inspection.

Periodic special inspection.

**SPECIAL INSPECTOR.**

**SPRAYED FIRE-RESISTANT MATERIALS.**

**STRUCTURAL OBSERVATION.**

### SECTION 1703 APPROVALS

**1703.1 Approved agency.** An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements.

**1703.1.1 Independence.** An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall also disclose possible conflicts of interest so that objectivity can be confirmed.

**1703.1.2 Equipment.** An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

**1703.1.3 Personnel.** An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.

**1703.2 Written approval.** Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

**1703.3 Approved record.** For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be open to public inspection at appropriate times.

**1703.4 Performance.** Specific information consisting of test reports conducted by an approved testing agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the material meets the applicable code requirements.

**1703.4.1 Research and investigation.** Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the applicant.

**1703.4.2 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**1703.5 Labeling.** Where materials or assemblies are required by this code to be labeled, such materials and assemblies shall be labeled by an approved agency in accordance with Section 1703. Products and materials required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703.5.1 through 1703.5.4.

**1703.5.1 Testing.** An approved agency shall test a representative sample of the product or material being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record

shall provide sufficient detail to verify compliance with the test standard.

**1703.5.2 Inspection and identification.** The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product or material is representative of the product or material tested.

**1703.5.3 Label information.** The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or material's performance characteristics and approved agency's identification.

**1703.5.4 Method of labeling.** Information required to be permanently identified on the product shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

**1703.6 Evaluation and follow-up inspection services.** Where structural components or other items regulated by this code are not visible for inspection after completion of a pre-fabricated assembly, the applicant shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

**1703.6.1 Follow-up inspection.** The applicant shall provide for special inspections of fabricated items in accordance with Section 1704.2.5.

**1703.6.2 Test and inspection records.** Copies of necessary test and inspection records shall be filed with the building official.

## SECTION 1704 SPECIAL INSPECTIONS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATIONS

**1704.1 General.** This section provides minimum requirements for special inspections, the statement of special inspections, contractor responsibility and structural observations.

**1704.2 Special inspections.** Where application is made for construction as described in this section, the owner or the registered design professional in responsible charge acting as the owner's agent shall employ one or more approved agencies to perform inspections during construction on the types of work listed under Section 1705. These inspections are in addition to the inspections identified in Section 110.

### Exceptions:

1. Special inspections are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.

2. Unless otherwise required by the building official, special inspections are not required for Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.

3. Special inspections are not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.7 or the conventional light-frame construction provisions of Section 2308. *[OSHPD 2] Not permitted by OSHPD.*

4. *[HCD 1] The provisions of Health and Safety Code Division 13, Part 6 and the California Code of Regulations, Title 25, Division 1, Chapter 3, commencing with Section 3000, shall apply to the construction and inspection of factory-built housing as defined in Health and Safety Code Section 19971.*

**1704.2.1 Special inspector qualifications.** The special inspector shall provide written documentation to the building official demonstrating his or her competence and relevant experience or training. Experience or training shall be considered relevant when the documented experience or training is related in complexity to the same type of special inspection activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as the approved agency and their personnel are permitted to act as the special inspector for the work designed by them, provided they qualify as special inspectors.

**1704.2.2 Access for special inspection.** The construction or work for which special inspection is required shall remain accessible and exposed for special inspection purposes until completion of the required special inspections.

**1704.2.3 Statement of special inspections.** The applicant shall submit a statement of special inspections in accordance with Section 107.1 *Chapter 1, Division II*, as a condition for permit issuance. This statement shall be in accordance with Section 1704.3.

**Exception:** A statement of special inspections is not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.7 or the conventional light-frame construction provisions of Section 2308.

**1704.2.4 Report requirement.** Special inspectors shall keep records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge. Reports shall indicate that work inspected was or was not completed in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design

professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon prior to the start of work by the applicant and the building official.

**1704.2.5 Inspection of fabricators.** Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by this section and as required elsewhere in this code.

**1704.2.5.1 Fabrication and implementation procedures.** The special inspector shall verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards. The special inspector shall review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

**Exception:** Special inspections as required by Section 1704.2.5 shall not be required where the fabricator is approved in accordance with Section 1704.2.5.2.

**1704.2.5.2 Fabricator approval.** Special inspections required by Section 1705 are not required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents.

4. Additional requirements for special inspection or testing for seismic or wind resistance as specified in Sections 1705.10, 1705.11 and 1705.12.
5. For each type of special inspection, identification as to whether it will be continuous special inspection or periodic special inspection.

**1704.3.2 Seismic requirements in the statement of special inspections.** Where Section 1705.11 or 1705.12 specifies special inspection, testing or qualification for seismic resistance, the statement of special inspections shall identify the designated seismic systems and seismic force-resisting systems that are subject to special inspections.

**1704.3.3 Wind requirements in the statement of special inspections.** Where Section 1705.10 specifies special inspection for wind requirements, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components subject to special inspection.

**1704.4 Contractor responsibility.** Each contractor responsible for the construction of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspection.

**1704.5 Structural observations.** Where required by the provisions of Section 1704.5.1 or 1704.5.2, the owner shall employ a registered design professional to perform structural observations as defined in Section 1702.

Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations.

At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies which, to the best of the structural observer's knowledge, have not been resolved.

**1704.5.1 Structural observations for seismic resistance.** Structural observations shall be provided for those structures assigned to Seismic Design Category D, E or F where one or more of the following conditions exist:

1. The structure is classified as Risk Category III or IV in accordance with Table 1604.5.
2. The height of the structure is greater than 75 feet (22 860 mm) above the base.
3. The structure is assigned to Seismic Design Category E, is classified as Risk Category I or II in accordance with Table 1604.5, and is greater than two stories above grade plane.
4. When so designated by the registered design professional responsible for the structural design.

**1704.3 Statement of special inspections.** Where special inspection or testing is required by Section 1705, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

**Exception:** The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

**1704.3.1 Content of statement of special inspections.** The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspection or testing by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.

## STRUCTURAL TESTS AND SPECIAL INSPECTIONS

- When such observation is specifically required by the building official.

**1704.5.2 Structural observations for wind requirements.** Structural observations shall be provided for those structures sited where  $V_{asd}$  as determined in accordance with Section 1609.3.1 exceeds 110 mph (49 m/sec), where one or more of the following conditions exist:

- The structure is classified as Risk Category III or IV in accordance with Table 1604.5.
- The building height of the structure is greater than 75 feet (22 860 mm).
- When so designated by the registered design professional responsible for the structural design.
- When such observation is specifically required by the building official.

### SECTION 1705 REQUIRED VERIFICATION AND INSPECTION

**1705.1 General.** Verification and inspection of elements of buildings and structures shall be as required by this section.

**1705.1.1 Special cases.** Special inspections shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

- Construction materials and systems that are alternatives to materials and systems prescribed by this code.
- Unusual design applications of materials described in this code.
- Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

**1705.2 Steel construction.** The special inspections for steel elements of buildings and structures shall be as required in this section.

**Exception:** Special inspection of the steel fabrication process shall not be required where the fabricator does not perform any welding, thermal cutting or heating operation of any kind as part of the fabrication process. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification, and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements when required by the approved construction documents.

**TABLE 1705.2.2  
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION OTHER THAN STRUCTURAL STEEL**

VERIFICATION AND INSPECTION	CONTINUOUS		PERIODIC	REFERENCED STANDARD <sup>a</sup>
1. Material verification of cold-formed steel deck:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—		X	Applicable ASTM material standards
b. Manufacturer’s certified test reports.	—		X	
2. Inspection of welding:				
a. Cold-formed steel deck:				
1) Floor and roof deck welds.	—		X	AWS D1.3
b. Reinforcing steel:				
1)Verification of weldability of reinforcing steel other than ASTM A 706.	—		X	AWS D1.4 ACI 318: Section 3.5.2
2) Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.		X	—	
3) Shear reinforcement.		X	—	
4) Other reinforcing steel.		—	X	

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1705.11, Special inspections for seismic resistance.

**1705.2.1 Structural steel.** Special inspection for structural steel shall be in accordance with the quality assurance inspection requirements of AISC 360.

**1705.2.2 Steel construction other than structural steel.** Special inspection for steel construction other than structural steel shall be in accordance with Table 1705.2.2 and this section.

**1705.2.2.1 Welding.** Welding inspection and welding inspector qualification shall be in accordance with this section.

**1705.2.2.1.1 Cold-formed steel.** Welding inspection and welding inspector qualification for cold-

formed steel floor and roof decks shall be in accordance with AWS D1.3.

**1705.2.2.1.2 Reinforcing steel.** Welding inspection and welding inspector qualification for reinforcing steel shall be in accordance with AWS D1.4 and ACI 318.

**1705.2.2.2 Cold-formed steel trusses spanning 60 feet or greater.** Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

**TABLE 1705.3  
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION**

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD <sup>a</sup>	IBC REFERENCE
1. Inspection of reinforcing steel, including prestressing tendons, and placement.	—	X	ACI 318: 3.5, 7.1-7.7	1910.4
2. Inspection of reinforcing steel welding in accordance with Table 1705.2.2, Item 2b.	—	—	AWS D1.4 ACI 318: 3.5.2	—
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used.	—	X	ACI 318: 8.1.3, 21.2.8	1908.5, 1909.1
4. Inspection of anchors post-installed in hardened concrete members <sup>b</sup> .	—	X	ACI 318: 3.8.6, 8.1.3, 21.2.8	1909.1
5. Verifying use of required design mix.	—	X	ACI 318: Ch. 4, 5.2-5.4	1904.2, 1910.2, 1910.3
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	1910.10
7. Inspection of concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 5.9, 5.10	1910.6, 1910.7, 1910.8
8. Inspection for maintenance of specified curing temperature and techniques.	—	X	ACI 318: 5.11-5.13	1910.9
9. Inspection of prestressed concrete: a. Application of prestressing forces. b. Grouting of bonded prestressing tendons in the seismic force-resisting system.	X X	—	ACI 318: 18.20 ACI 318: 18.18.4	—
10. Erection of precast concrete members.	—	X	ACI 318: Ch. 16	—
11. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 6.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 6.1.1	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1705.11, Special inspections for seismic resistance.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with ACI 355.2 or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.



**1705.3 Concrete construction.** The special inspections and verifications for concrete construction shall be as required by this section and Table 1705.3.

**Exception:** Special inspections shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above grade plane that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above grade plane that are fully supported on earth or rock where:
  - 2.1. The footings support walls of light-frame construction;
  - 2.2. The footings are designed in accordance with Table 1809.7; or
  - 2.3. The structural design of the footing is based on a specified compressive strength,  $f'_c$ , no greater than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the construction documents or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

**1705.3.1 Materials.** In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapter 3 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapter 3 of ACI 318. Weldability of reinforcement, except that which conforms to ASTM A 706, shall be determined in accordance with the requirements of Section 3.5.2 of ACI 318.

**1705.4 Masonry construction.** Masonry construction shall be inspected and verified in accordance with TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6 quality assurance program requirements.

**Exception:** Special inspections shall not be required for:

1. Empirically designed masonry, glass unit masonry or masonry veneer designed by Section 2109, 2110 or Chapter 14, respectively, where they are part of structures classified as Risk Category I, II or III in accordance with Section 1604.5.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

**1705.4.1 Empirically designed masonry, glass unit masonry and masonry veneer in Risk Category IV.** The minimum special inspection program for empirically

designed masonry, glass unit masonry or masonry veneer designed by Section 2109, 2110 or Chapter 14, respectively, in structures classified as Risk Category IV, in accordance with Section 1604.5, shall comply with TMS 402/ACI 530/ASCE 5 Level B Quality Assurance.

**1705.4.2 Vertical masonry foundation elements.** Special inspection shall be performed in accordance with Section 1705.4 for vertical masonry foundation elements.

**1705.5 Wood construction.** Special inspections of the fabrication process of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704.2.5. Special inspections of site-built assemblies shall be in accordance with this section.

**1705.5.1 High-load diaphragms.** High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved building plans. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved building plans.

**1705.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater.** Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

**1705.5.3 [OSHPD 2] Manufactured trusses and assemblies.** *The fabrication of trusses and other assemblages constructed using wood and metal members, or using light metal plate connectors, shall be continuously inspected by a qualified inspector approved by the enforcement agency. The inspector shall furnish the architect, structural engineer and the enforcement agency with a report that the lumber species, grades and moisture content; type of glue, temperature and gluing procedure; type of metal members and metal plate connectors; and the workmanship conform in every material respect with the duly approved plans and specifications. Each inspected truss shall be stamped by the inspector with an identifying mark.*

**1705.6 Soils.** Special inspections for existing site soil conditions, fill placement and load-bearing requirements shall be as required by this section and Table 1705.6. The approved geotechnical report, and the construction documents prepared by the registered design professionals shall be used to determine compliance. During fill placement, the special inspector shall determine that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report.

**Exception:** Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.

**1705.7 Driven deep foundations.** Special inspections shall be performed during installation and testing of driven deep foundation elements as required by Table 1705.7. The approved instruction documents prepared by the registered design professionals, shall be used to determine compliance.

**1705.8 Cast-in-place deep foundations.** Special inspections shall be performed during installation and testing of cast-in-place deep foundation elements as required by Table 1705.8. The approved geotechnical report, and the construction documents prepared by the registered design professionals, shall be used to determine compliance.

**1705.9 Helical pile foundations.** Special inspections shall be performed continuously during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation

data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

**1705.10 Special inspections for wind resistance.** Special inspections itemized in Sections 1705.10.1 through 1705.10.3, unless exempted by the exceptions to Section 1704.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where  $V_{asd}$  as determined in accordance with Section 1609.3.1 is 120 miles per hour (52.8 m/sec) or greater.
2. In wind Exposure Category C or D, where  $V_{asd}$  as determined in accordance with Section 1609.3.1 is 110 mph (49 m/sec) or greater.

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**TABLE 1705.6  
REQUIRED VERIFICATION AND INSPECTION OF SOILS**

VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly.	—	X

**TABLE 1705.7  
REQUIRED VERIFICATION AND INSPECTION OF DRIVEN DEEP FOUNDATION ELEMENTS**

VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Observe driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional inspections in accordance with Section 1705.2.	—	—
6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3.	—	—
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	—	—

**TABLE 1705.8**  
**REQUIRED VERIFICATION AND INSPECTION OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS**

VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Observe drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform additional inspections in accordance with Section 1705.3.	—	—

**1705.10.1 Structural wood.** Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

**Exception:** Special inspection is not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other components of the main windforce-resisting system, where the fastener spacing of the sheathing is more than 4 inches (102 mm) on center.

**1705.10.2 Cold-formed steel light-frame construction.** Periodic special inspection is required during welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**Exception:** Special inspection is not required for cold-formed steel light-frame shear walls, braces, diaphragms, collectors (drag struts) and hold-downs where either of the following apply:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the fastener spacing of the sheathing is more than 4 inches (102 mm) on center (o.c.).

**1705.10.3 Wind-resisting components.** Periodic special inspection is required for the following systems and components:

1. Roof cladding.
2. Wall cladding.

**1705.11 Special inspections for seismic resistance.** Special inspections itemized in Sections 1705.11.1 through 1705.11.8, unless exempted by the exceptions of Section 1704.2, are required for the following:

1. The seismic force-resisting systems in structures assigned to Seismic Design Category C, D, E or F in accordance with Sections 1705.11.1 through 1705.11.3, as applicable.
2. Designated seismic systems in structures assigned to Seismic Design Category C, D, E or F in accordance with Section 1705.11.4.
3. Architectural, mechanical and electrical components in accordance with Sections 1705.11.5 and 1705.11.6.
4. Storage racks in structures assigned to Seismic Design Category D, E or F in accordance with Section 1705.11.7.
5. Seismic isolation systems in accordance with Section 1705.11.8.

**Exception:** Special inspections itemized in Sections 1705.11.1 through 1705.11.8 are not required for structures designed and constructed in accordance with one of the following:

1. The structure consists of light-frame construction; the design spectral response acceleration at short periods,  $S_{DS}$ , as determined in Section 1613.3.4, does not exceed 0.5; and the building height of the structure does not exceed 35 feet (10 668 mm).
2. The seismic force-resisting system of the structure consists of reinforced masonry or reinforced concrete; the design spectral response acceleration at short periods,  $S_{DS}$ , as determined in Section 1613.3.4, does not exceed 0.5; and the building height of the structure does not exceed 25 feet (7620 mm).
3. The structure is a detached one- or two-family dwelling not exceeding two stories above grade plane and does not have any of the following horizontal or vertical irregularities in accordance with Section 12.3 of ASCE 7:
  - 3.1. Torsional or extreme torsional irregularity.
  - 3.2. Nonparallel systems irregularity.
  - 3.3. Stiffness-soft story or stiffness-extreme soft story irregularity.
  - 3.4. Discontinuity in lateral strength-weak story irregularity.

**1705.11.1 Structural steel.** Special inspection for structural steel shall be in accordance with the quality assurance requirements of AISC 341.

**Exception:** Special inspections of structural steel in structures assigned to Seismic Design Category C that are not specifically detailed for seismic resistance, with a response modification coefficient,  $R$ , of 3 or less, excluding cantilever column systems.

**1705.11.2 Structural wood.** Continuous special inspection is required during field gluing operations of elements of the seismic force-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

**Exception:** Special inspection is not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other components of the seismic force-resisting system, where the fastener spacing of the sheathing is more than 4 inches (102 mm) on center (o.c.).

**1705.11.3 Cold-formed steel light-frame construction.** Periodic special inspection is required during welding operations of elements of the seismic force-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**Exception:** Special inspection is not required for cold-formed steel light-frame shear walls, braces, diaphragms, collectors (drag struts) and hold-downs where either of the following apply:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the fastener spacing of the sheathing is more than 4 inches (102 mm) o.c.

**1705.11.4 Designated seismic systems.** The special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section 1705.12.3 and verify that the label, anchorage or mounting conforms to the certificate of compliance.

**1705.11.5 Architectural components.** Periodic special inspection is required during the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

**Exceptions:**

1. Special inspection is not required for exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer 30 feet (9144 mm) or less in height above grade or walking surface.

2. Special inspection is not required for exterior cladding and interior and exterior veneer weighing 5 psf (24.5 N/m<sup>2</sup>) or less.
3. Special inspection is not required for interior nonbearing walls weighing 15 psf (73.5 N/m<sup>2</sup>) or less.

**1705.11.5.1 Access floors.** Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

**1705.11.6 Mechanical and electrical components.** Special inspection for mechanical and electrical components shall be as follows:

1. Periodic special inspection is required during the anchorage of electrical equipment for emergency or standby power systems in structures assigned to Seismic Design Category C, D, E or F;
2. Periodic special inspection is required during the anchorage of other electrical equipment in structures assigned to Seismic Design Category E or F;
3. Periodic special inspection is required during the installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F;
4. Periodic special inspection is required during the installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category C, D, E or F; and
5. Periodic special inspection is required during the installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the construction documents require a nominal clearance of  $\frac{1}{4}$  inch (6.4 mm) or less between the equipment support frame and restraint.

**1705.11.7 Storage racks.** Periodic special inspection is required during the anchorage of storage racks 8 feet (2438 mm) or greater in height in structures assigned to Seismic Design Category D, E or F.

**1705.11.8 Seismic isolation systems.** Periodic special inspection shall be provided for seismic isolation systems during the fabrication and installation of isolator units and energy dissipation devices.

**1705.12 Testing and qualification for seismic resistance.** The testing and qualification specified in Sections 1705.12.1 through 1705.12.4, unless exempted from special inspections by the exceptions of Section 1704.2 are required as follows:

1. The seismic force-resisting systems in structures assigned to Seismic Design Category C, D, E or F shall meet the requirements of Sections 1705.12.1 and 1705.12.2, as applicable.
2. Designated seismic systems in structures assigned to Seismic Design Category C, D, E or F and subject to the certification requirements of ASCE 7 Section 13.2.2 shall comply with Section 1705.12.3.

3. Architectural, mechanical and electrical components in structures assigned to Seismic Design Category C, D, E or F and where the requirements of ASCE 7 Section 13.2.1 are met by submittal of manufacturer's certification, in accordance with Item 2 therein, shall comply with Section 1705.12.3.
4. The seismic isolation system in seismically isolated structures shall meet the testing requirements of Section 1705.12.4.

**1705.12.1 Concrete reinforcement.** Where reinforcement complying with ASTM A 615 is used to resist earthquake-induced flexural and axial forces in special moment frames, special structural walls and coupling beams connecting special structural walls, in structures assigned to Seismic Design Category B, C, D, E or F, the reinforcement shall comply with Section 21.1.5.2 of ACI 318. Certified mill test reports shall be provided for each shipment of such reinforcement. Where reinforcement complying with ASTM A 615 is to be welded, chemical tests shall be performed to determine weldability in accordance with Section 3.5.2 of ACI 318.

**1705.12.2 Structural steel.** Testing for structural steel shall be in accordance with the quality assurance requirements of AISC 341.

**Exception:** Testing for structural steel in structures assigned to Seismic Design Category C that are not specifically detailed for seismic resistance, with a response modification coefficient,  $R$ , of 3 or less, excluding cantilever column systems.

**1705.12.3 Seismic certification of nonstructural components.** The registered design professional shall specify on the construction documents the requirements for certification by analysis, testing or experience data for nonstructural components and designated seismic systems in accordance with Section 13.2 of ASCE 7, where such certification is required by Section 1705.12.

**1705.12.4 Seismic isolation systems.** Seismic isolation systems shall be tested in accordance with Section 17.8 of ASCE 7.

**1705.13 Sprayed fire-resistant materials.** Special inspections for sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be in accordance with Sections 1705.13.1 through 1705.13.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, where applicable.

**1705.13.1 Physical and visual tests.** The special inspections shall include the following tests and observations to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.
2. Thickness of application.

3. Density in pounds per cubic foot ( $\text{kg}/\text{m}^3$ ).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

**1705.13.2 Structural member surface conditions.** The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected before the application of the sprayed fire-resistant material.

**1705.13.3 Application.** The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

**1705.13.4 Thickness.** No more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705.13.4.1.

**1705.13.4.1 Minimum allowable thickness.** For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus  $\frac{1}{4}$  inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E 605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705.13.4.2 and 1705.13.4.3.

**1705.13.4.2 Floor, roof and wall assemblies.** The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E 605, making not less than four measurements for each 1,000 square feet (93  $\text{m}^2$ ) of the sprayed area, or portion thereof, in each story.

**1705.13.4.3 Cellular decks.** Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. A minimum of four measurements shall be made, located symmetrically within the square area.

**1705.13.4.4 Fluted decks.** Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. A minimum of four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

**1705.13.4.5 Structural members.** The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E 605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

**1705.13.4.6 Beams and girders.** At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

**1705.13.4.7 Joists and trusses.** At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

**1705.13.4.8 Wide-flanged columns.** At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

**1705.13.4.9 Hollow structural section and pipe columns.** At hollow structural section and pipe columns, thickness measurements shall be made at a minimum of four locations around the column at each end of a 12-inch (305 mm) length.

**1705.13.5 Density.** The density of the sprayed fire-resistant material shall not be less than the density specified in the approved fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E 605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**1705.13.6 Bond strength.** The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall not be less than 150 pounds per square foot (psf) (7.18 kN/m<sup>2</sup>). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E 736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705.13.6.1 through 1705.13.6.3.

**1705.13.6.1 Floor, roof and wall assemblies.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) of the sprayed area, or portion thereof, in each story.

**1705.13.6.2 Structural members.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**1705.13.6.3 Primer, paint and encapsulant bond tests.** Bond tests to qualify a primer, paint or encapsu-

lant shall be conducted when the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

**1705.14 Mastix and intumescent fire-resistant coatings.** Special inspections for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be in accordance with AWCI 12-B. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents.

**1705.15 Exterior insulation and finish systems (EIFS).** Special inspections shall be required for all EIFS applications.

#### Exceptions:

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

**1705.15.1 Water-resistive barrier coating.** A water-resistive barrier coating complying with ASTM E 2570 requires special inspection of the water-resistive barrier coating when installed over a sheathing substrate.

**1705.16 Fire-resistant penetrations and joints.** In high-rise buildings or in buildings assigned to Risk Category III or IV in accordance with Section 1604.5, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems, and perimeter fire barrier systems that are tested and listed in accordance with Sections 714.3.1.2, 714.4.1.2, 715.3 and 715.4 shall be in accordance with Section 1705.16.1 or 1705.16.2.

**1705.16.1 Penetration firestops.** Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.3.1.2 and 714.4.1.2 shall be conducted by an approved inspection agency in accordance with ASTM E 2174.

**1705.16.2 Fire-resistant joint systems.** Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3 and 715.4 shall be conducted by an approved inspection agency in accordance with ASTM E 2393.

**[F] 1705.17 Special inspection for smoke control.** Smoke control systems shall be tested by a special inspector.

**[F] 1705.17.1 Testing scope.** The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow

measurements and detection and control verification.

**[F] 1705.17.2 Qualifications.** Special inspection agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

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## SECTION 1706

### DESIGN STRENGTHS OF MATERIALS

**1706.1 Conformance to standards.** The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

**1706.2 New materials.** For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707.

## SECTION 1707

### ALTERNATIVE TEST PROCEDURE

**1707.1 General.** In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11 *Chapter 1, Division II*. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.

*[BSC] In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 1.2.2, Chapter 1, Division I. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.*

*[HCD 1 & HCD 2] In the absence of approved rules or other approved standards, the building official shall make, or cause to be made the necessary tests and investigations, or the building official shall accept duly authenticated reports from approved agencies with respect to the quality and manner of use of new materials or assemblies as provided for in Section 1.8.7, Chapter 1, Division 1. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.*

## SECTION 1708

### TEST SAFE LOAD

**1708.1 Where required.** Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1710. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

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## SECTION 1709

### IN-SITU LOAD TESTS

**1709.1 General.** Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. If the structural assessment determines that the load-bearing capacity is less than that required by the code, load tests shall be conducted in accordance with Section 1709.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

**1709.2 Test standards.** Structural components and assemblies shall be tested in accordance with the appropriate referenced standards. In the absence of a standard that contains an applicable load test procedure, the test procedure shall be developed by a registered design professional and approved. The test procedure shall simulate loads and conditions of application that the completed structure or portion thereof will be subjected to in normal use.

**1709.3 In-situ load tests.** In-situ load tests shall be conducted in accordance with Section 1709.3.1 or 1709.3.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

**1709.3.1 Load test procedure specified.** Where a referenced standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1709.3.2 shall apply.

**1709.3.2 Load test procedure not specified.** In the absence of applicable load test procedures contained

within a standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic load-resisting system, the test load shall be equal to two times the unfactored design loads. The test load shall be left in place for a period of 24 hours. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

## SECTION 1710 PRECONSTRUCTION LOAD TESTS

**1710.1 General.** In evaluating the physical properties of materials and methods of construction that are not capable of being designed by approved engineering analysis or do not comply with the applicable referenced standards, the structural adequacy shall be predetermined based on the load test criteria established in this section.

**1710.2 Load test procedures specified.** Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1710.3 shall apply.

**1710.3 Load test procedures not specified.** Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1710.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

**1710.3.1 Test procedure.** The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in

Section 1710.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1710.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in Section 1710.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

**1710.3.2 Deflection.** The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3.

**1710.4 Wall and partition assemblies.** Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

**1710.5 Exterior window and door assemblies.** The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1710.5.1 or 1710.5.2.

**Exception:** Structural wind load design pressures for window units smaller than the size tested in accordance with Section 1710.5.1 or 1710.5.2 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the small unit shall be the same as the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window unit having the highest allowable design pressure.

**1710.5.1 Exterior windows and doors.** Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1710.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

**1710.5.2 Exterior windows and door assemblies not provided for in Section 1710.5.1.** Exterior window and door assemblies shall be tested in accordance with ASTM E 330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E 330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly



shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

**1710.6 Skylights and sloped glazing.** Unit skylights and tubular daylighting devices (TDDs) shall comply with the requirements of Section 2405. All other skylights and sloped glazing shall comply with the requirements of Chapter 24.

**1710.7 Test specimens.** Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

## SECTION 1711 MATERIAL AND TEST STANDARDS

**1711.1 Joist hangers.** Testing of joist hangers shall be in accordance with Sections 1711.1.1 through 1711.1.3, as applicable.

**1711.1.1 General.** The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D 1761 using lumber having a specific gravity of 0.49 or greater, but not greater than 0.55, as determined in accordance with AF&PA NDS for the joist and headers.

**Exception:** The joist length shall not be required to exceed 24 inches (610 mm).

**1711.1.2 Vertical load capacity for joist hangers.** The vertical load-bearing capacity for the joist hanger shall be determined by testing a minimum of three joist hanger assemblies as specified in ASTM D 1761. If the ultimate vertical load for any one of the tests varies more than 20 percent from the average ultimate vertical load, at least three additional tests shall be conducted. The allowable vertical load-bearing of the joist hanger shall be the lowest value determined from the following:

1. The lowest ultimate vertical load for a single hanger from any test divided by three (where three tests are conducted and each ultimate vertical load does not vary more than 20 percent from the average ultimate vertical load).
2. The average ultimate vertical load for a single hanger from all tests divided by three (where six or more tests are conducted).
3. The average from all tests of the vertical loads that produce a vertical movement of the joist with respect to the header of  $\frac{1}{8}$  inch (3.2 mm).
4. The sum of the allowable design loads for nails or other fasteners utilized to secure the joist hanger to the wood members and allowable bearing loads that contribute to the capacity of the hanger.

5. The allowable design load for the wood members forming the connection.

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**1711.1.2.1 Design value modifications for joist hangers.** Allowable design values for joist hangers that are determined by Item 4 or 5 in Section 1711.1.2 shall be permitted to be modified by the appropriate load duration factors as specified in AF&PA NDS but shall not exceed the direct loads as determined by Item 1, 2 or 3 in Section 1711.1.2. Allowable design values determined by Item 1, 2 or 3 in Section 1711.1.2 shall not be modified by load duration factors.

**1711.1.3 Torsional moment capacity for joist hangers.** The torsional moment capacity for the joist hanger shall be determined by testing at least three joist hanger assemblies as specified in ASTM D 1761. The allowable torsional moment of the joist hanger shall be the average torsional moment at which the lateral movement of the top or bottom of the joist with respect to the original position of the joist is  $\frac{1}{8}$  inch (3.2 mm).

**1711.2 Concrete and clay roof tiles.** Testing of concrete and clay roof tiles shall be in accordance with Sections 1711.2.1 and 1711.2.2, as applicable.

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**1711.2.1 Overturning resistance.** Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with SBCCI SSTD 11 and Chapter 15.

**1711.2.2 Wind tunnel testing.** Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11 and Chapter 15.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 17A – STRUCTURAL TESTS AND SPECIAL INSPECTIONS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter							X	X	X			X								
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter / Section																				



## CHAPTER 17A

# SPECIAL INSPECTIONS AND TESTS

### SECTION 1701A GENERAL

**1701A.1 Scope.** The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

**1701A.1.1 Application.** *The scope of application of Chapter 17A is as follows:*

1. Structures regulated by the Division of the State Architect-Structural Safety, which include those applications listed in Sections 1.9.2.1 (DSA-SS), and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.
2. Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1, and 1.10.4. These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.

**Exception:** [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 17 and any applicable amendments therein.

**1701A.1.2 Amendments in this chapter.** DSA-SS adopts this chapter and all amendments.

**Exceptions:** Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. Division of the State Architect - Structural Safety:  
[DSA-SS] For applications listed in Section 1.9.2.1.  
[DSA-SS/CC] For applications listed in Section 1.9.2.2.
2. Office of Statewide Health Planning and Development:  
[OSHPD 1] – For applications listed in Section 1.10.1.  
[OSHPD 4] – For applications listed in Section 1.10.4.

**1701A.1.3 Reference to other chapters.**

**1701A.1.3.1 [DSA-SS/CC]** Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A,

22A, and 34A, the provisions in Chapters 16, 19, 21, 22, and 34 respectively shall apply instead.

**1701A.2 New materials.** New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

**1701A.3 Used materials.** The use of second-hand materials that meet the minimum requirements of this code for new materials shall be permitted.

**1701A.4 Special inspectors. [OSHPD 1 and 4]** In addition to the inspector(s) of record required by the California Administrative Code (CCR, Title 24, Part 1), Section 7-144, the owner shall employ one or more special inspectors who shall provide inspections during construction on the types of work listed under Chapters 17A, 18A, 19A, 20, 21A, 22A, 23, 25, 34A, and noted in the Test, Inspection, and Observation (TIO) program required by Sections 7-141, 7-145 and 7-149, of the California Administrative Code. Test, Inspection and Observation (TIO) program shall satisfy requirements of Sections 1704A.2.3 and 1704A.5.

**1701A.5 Special inspectors. [DSA-SS & DSA-SS/CC]** In addition to the project inspector required by the California Administrative Code (CCR, Title 24, Part 1), Section 4-333, the owner shall employ one or more special inspectors who shall provide inspections during construction on the types of work listed under Chapters 17A, 18A, 19A, 20, 21A, 22A, 23, 25 and 34 of the California Building Code and noted in the special test, inspection and observation plan required by Section 4-335 of the California Administrative Code.

### SECTION 1702A DEFINITIONS

**1702A.1 Definitions.** The following terms are defined in Chapter 2, except those defined below which shall, for the purposes of this section, have the meanings shown herein.

**APPROVED AGENCY.**

**APPROVED FABRICATOR.**

**CERTIFICATE OF COMPLIANCE.**

**DESIGNATED SEISMIC SYSTEM.**

**FABRICATED ITEM.**

**INSPECTION CERTIFICATE.**

**INTUMESCENT FIRE-RESISTANT COATINGS.**

**MAIN WINDFORCE-RESISTING SYSTEM.****MASTIC FIRE-RESISTANT COATINGS.**

**PROJECT INSPECTOR.** [DSA-SS, DSA-SS/CC] *The person approved to provide inspection in accordance with the California Administrative Code, Section 4-333(b). The term “project inspector” is synonymous with “inspector of record.”*

**SPECIAL INSPECTION.**

**Continuous special inspection.** *The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.*

**Periodic special inspection.** *The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.*

**SPECIAL INSPECTOR.****SPRAYED FIRE-RESISTANT MATERIALS.****STRUCTURAL OBSERVATION.**

## **SECTION 1703A APPROVALS**

**1703A.1 Approved agency.** An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements.

**1703A.1.1 Independence.** An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall also disclose possible conflicts of interest so that objectivity can be confirmed.

**1703A.1.2 Equipment.** An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

**1703A.1.3 Personnel.** An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.

**1703A.2 Written approval.** Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

**1703A.3 Approved record.** For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be open to public inspection at appropriate times.

**1703A.4 Performance.** Specific information consisting of test reports conducted by an approved testing agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the material meets the applicable code requirements.

**1703A.4.1 Research and investigation.** Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the applicant.

**1703A.4.2 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**1703A.5 Labeling.** Where materials or assemblies are required by this code to be labeled, such materials and assemblies shall be labeled by an approved agency in accordance with Section 1703A. Products and materials required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703A.5.1 through 1703A.5.4.

**1703A.5.1 Testing.** An approved agency shall test a representative sample of the product or material being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

**1703A.5.2 Inspection and identification.** The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product or material is representative of the product or material tested.

**1703A.5.3 Label information.** The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or material's performance characteristics and approved agency's identification.

**1703A.5.4 Method of labeling.** Information required to be permanently identified on the product shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

**1703A.6 Evaluation and follow-up inspection services.** Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the applicant shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

**1703A.6.1 Follow-up inspection.** The applicant shall provide for special inspections of fabricated items in accordance with Section 1704.2.5.

**1703A.6.2 Test and inspection records.** Copies of necessary test and inspection records shall be filed with the building official.

## SECTION 1704A SPECIAL INSPECTIONS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATIONS

**1704A.1 General.** This section provides minimum requirements for special inspections, the statement of special inspections, contractor responsibility and structural observations.

**1704A.2 Special inspections.** Where application is made for construction as described in this section, the owner shall employ one or more approved agencies to perform inspections during construction on the types of work listed under Section 1705A. These inspections are in addition to the inspections identified in Section 110.

**Exception:** Special inspections are not required for construction of a minor nature or as warranted by conditions in the jurisdiction, as approved by the building official.

**1704A.2.1 Special inspector qualifications.** The special inspector shall provide written documentation to the building official demonstrating his or her competence and relevant experience or training. Experience or training shall be considered relevant when the documented experience or training is related in complexity to the same type of special inspection activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as the approved agency and their personnel are permitted to act as the special inspector for the work designed by them, provided they qualify as special inspectors.

**1704A.2.2 Access for special inspection.** The construction or work for which special inspection is required shall remain accessible and exposed for special inspection purposes until completion of the required special inspections.

**1704A.2.3 Statement of special inspections.** The applicant shall submit a statement of special inspections *prepared by the registered design professional in general responsible charge* in accordance with Section 107.1 as a condition for *construction documents review*. This statement shall be in accordance with Section 1704A.3.

**1704A.2.4 Report requirement.** *The inspector(s) of record and special inspectors shall keep records of inspections. The inspector of record and special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge as required by the California Administrative Code. Reports shall indicate that work inspected was or was not completed in conformance to approved construction documents as required by Title 24 Parts 1 and 2. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building*

official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon prior to the start of work by the applicant and the building official.

**1704A.2.5 Inspection of fabricators.** Where fabrication of structural load-bearing members and assemblies is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by this section and as required elsewhere in this code.

**1704A.2.5.1 Fabrication and implementation procedures.** The special inspector shall verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards. The special inspector shall review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

**1704A.3 Statement of special inspections.** Where special inspection or testing is required by Section 1705, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704A.2.3.

**Exception:** The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

**1704A.3.1 Content of statement of special inspections.** The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspection or testing by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspection or testing for seismic or wind resistance as specified in Sections 1705A.10, 1705A.11 and 1705A.12.
5. For each type of special inspection, identification as to whether it will be continuous special inspection or periodic special inspection.

**1704A.3.2 Seismic requirements in the statement of special inspections.** Where Section 1705A.11 or 1705A.12 specifies special inspection, testing or *certification* for seismic resistance, the statement of special inspections shall identify the *equipment/components that require special seismic certification* and seismic force-resisting systems that are subject to special inspections.

**1704A.3.3 Wind requirements in the statement of special inspections.** Where Section 1705A.10 specifies spe-

cial inspection for wind requirements, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components subject to special inspection.

**\*\* 1704A.4 Contractor responsibility.** Each contractor responsible for the construction of a main wind- or seismic force-resisting system, *installation of equipment/components requiring special seismic certification* or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspection.

**\*\* > 1704A.5 Structural observations.** The owner shall employ a registered design professional to perform structural observations as defined in Section 1702A.

Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations.

At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies which, to the best of the structural observer's knowledge, have not been resolved.

## SECTION 1705A REQUIRED VERIFICATION AND INSPECTION

**\*\* 1705A.1 General.** Verification and inspection of elements of buildings and structures shall be as required by this section.

**1705A.1.1 Special cases.** Special inspections shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

**\*\* 1705A.2 Steel construction.** The special inspections for steel elements of buildings and structures shall be as required in this section.

**Exception:** Special inspection of the steel fabrication process shall not be required where the fabricator does not perform any welding, thermal cutting or heating operation of any kind as part of the fabrication process. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabri-

cator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification, and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements when required by the approved construction documents.

**1705A.2.1 Structural steel.** Special inspections *and tests* of structural steel shall be in accordance with the quality assurance requirements of *this section and Chapter 22A*.

*AISC 360, Chapter N and AISC 341, Chapter J are adopted, except as noted below:*

*The following provisions of AISC 360, Chapter N are not adopted:*

- N4., Item 2. (*Quality Assurance Inspector Qualifications*)
- N5., Item 2. (*Quality Assurance*)
- N5., Item 3. (*Coordinated Inspection*)
- N5., Item 4. (*Inspection of Welding*)
- N7 (*Approved Fabricators and Erectors*)
- N8 (*Nonconforming Material and Workmanship*)

*In addition to the quality assurance inspection requirements contained in AISC 360, Section N5, Item 6 (Inspection of High Strength Bolting), the requirements of Table 1705A.2.1 of the California Building Code shall apply.*

*In addition to the quality assurance requirements contained in AISC 360, Section N6 (Minimum Requirements for Inspection of Composite Construction), the requirements of Table 1705A.2.1 of the California Building Code shall apply.*

*In addition to the quality assurance requirements contained in AISC 341, Chapter J, Section J5 (Inspection Tasks), the requirements of Section 1704A.3 and Table 1705A.2.1 of the California Building Code shall apply.*

**1705A.2.2 Steel construction.** Special inspection for steel construction shall be in accordance with Table 1705A.2.1 and this section.

**1705A.2.2.1 Welding.** Welding inspection and welding inspector qualification shall be in accordance with this section.

**1705A.2.2.1.1 Cold-formed steel.** Welding inspection and welding inspector qualification for cold-formed steel floor and roof decks shall be in accordance with AWS D1.3.

**1705A.2.2.1.2 Reinforcing steel.** Welding inspection and welding inspector qualification for reinforcing steel shall be in accordance with AWS D1.4 and ACI 318.

**1705A.2.2.2 Cold-formed steel trusses spanning 60 feet or greater.** Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special

**TABLE 1705A.2.1  
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION**

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD <sup>a</sup>	CBC REFERENCE
1. Material verification of high-strength bolts, nuts and washers:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	AISC 360, Section A3.3 and applicable ASTM material standards	—
b. Manufacturer's certificate of compliance required.	—	X	—	—
2. Inspection of high-strength bolting:				
a. Snug-tight joints.	—	X	AISC 360, Section M2.5	—
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation	—	X		—
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X	—		—
3. Material verification of structural steel and cold-formed steel deck:				
a. For structural steel, identification markings to conform to AISC 360.	—	X	AISC 360, Section A3.1	2203A.1
b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	Applicable ASTM material standards	
c. Manufacturer's certified test reports.	—	X	—	—
4. Material verification of weld filler materials:				
a. Identification markings to conform to AWS specification in the approved construction documents.	—	X	AISC 360, Section A3.5 and applicable AWS A5 documents	—
b. Manufacturer's certificate of compliance required.	—	X	—	—
5. Inspection of welding:				
a. Structural steel and cold-formed steel deck:				
1. Complete and partial joint penetration groove welds	X	—	AWS D1.1	1705A.2.2
2. Multipass fillet welds.	X	—		
3. Single-pass fillet welds > 5/16"	X	—		
4.Plug and slot welds.	X	—		
5. Single-pass fillet welds ≤ 5/16"	—	X	AWS D1.3	—
6. Floor and roof deck welds.	—	X		
b. Reinforcing steel:				
1. Verification of weldability of reinforcing steel other than ASTM A 706.	—	X	AWS D1.4. ACI 318: Section 3.5.2	—
2. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	X	—		—
3. Shear reinforcement.	X			—
4. Other reinforcing steel.	—	X		—
6. Inspection of steel frame joint details for compliance:				
a. Details such as bracing and stiffening.	—	X	—	1705A.2.2
b. Member locations.	—	X	—	
c. Application of joint details at each connection.	—	X	—	

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1705A.11, Special inspections for seismic resistance.



inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

**1705A.2.2.3 Steel joist and joist girder inspection.** *Special inspection is required during the manufacture and welding of steel joists or joist girders. The special inspector shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. The special inspector shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process.*

**1705A.2.2.4 Light-framed steel truss inspection.** *The manufacture of cold-formed light framed steel trusses shall be continuously inspected by a qualified special inspector approved by the enforcement agency. The special inspector shall verify conformance of materials and manufacture with approved plans and specifications. The special inspector shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected truss. This mark or tag shall remain on the truss throughout the job site receiving and erection process.*

**1705A.2.2.5 Inspection of structural welding.** *Inspection of all shop and field welding operations shall be made by a qualified welding inspector approved by the enforcement agency. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the AWS QC1. All welding inspectors shall be as approved by the enforcement agency.*

*The welding inspector shall make a systematic daily record of all welds. In addition to other required records, this record shall include:*

1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects.

*The welding inspector shall check the material, details of construction and procedure, as well as workmanship of the welds. The inspector shall verify that the installation of end-welded stud shear connectors is in accordance with the requirements of AWS D1.1 and the approved plans and specifications. The inspector shall furnish the architect, structural engineer, and the enforcement agency with a verified report that the welding is proper and has been done in conformity with AWS D1.1, D1.8, and the approved construction documents.*

**1705A.3 Concrete construction.** The special inspections and verifications for concrete construction shall be as required by this section and Table 1705A.3.

**Exception:** Special inspections shall not be required for concrete patios, driveways and sidewalks, on grade.

**1705A.3.1 Materials.** In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapter 3 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapter 3 of ACI 318. Weldability of reinforcement, except that which conforms to ASTM A 706, shall be determined in accordance with the requirements of Section 3.5.2 of ACI 318.

**1705A.3.2 Batch plant inspection.** *Except as provided under Section 1705A.4.3, the quality and quantity of materials used in transit-mixed concrete and in batched aggregates shall be continuously inspected by an approved special inspector at the location where materials are measured.*

**1705A.3.3 Waiver of continuous batch plant inspection.** *Continuous batch plant inspection may be waived by the registered design professional, subject to approval by the enforcement agency under either of the following conditions:*

1. *The concrete plant complies fully with the requirements of ASTM C 94, Sections 8 and 9, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.*
2. *For single -story light-framed - buildings and isolated foundations supporting equipment only, where the specified compressive strength  $f'_c$  of the concrete delivered to the jobsite is 3,500 psi (24.13 MPa) and where the  $f'_c$  used in design is not greater than 3,000 psi (20.68 MPa).*

*When continuous batch plant inspection is waived, the following periodic inspection requirements shall apply and shall be described in the construction documents:*

1. *Qualified technician of the testing laboratory shall check the first batch at the start of the day.*
2. *Licensed weighmaster to positively identify materials as to quantity and certify to each load by a batch ticket.*
3. *Batch tickets, including material quantities and weights shall accompany the load, shall be transmitted to the inspector of record by a truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector will keep a*

**TABLE 1705A.3  
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION**

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD <sup>a</sup>	IBC REFERENCE
1. Inspection of reinforcing steel, including prestressing tendons, and placement.	—	X	ACI 318: 3.5, 7.1-7.7	1910.4
2. Inspection of reinforcing steel welding in accordance with Table 1705.2.2, Item 2b.	—	—	AWS D1.4 ACI 318: 3.5.2	—
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used.	—	X	ACI 318: 8.1.3, 21.2.8	1908.5, 1909.1
4. Inspection of anchors post-installed in hardened concrete members <sup>b</sup> .	—	X	ACI 318: 3.8.6, 8.1.3, 21.2.8	1909.1
5. Verifying use of required design mix.	—	X	ACI 318: Ch. 4, 5.2-5.4	1904.2, 1910.2, 1910.3
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	1910.10
7. Inspection of concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 5.9, 5.10	1910.6, 1910.7, 1910.8
8. Inspection for maintenance of specified curing temperature and techniques.	—	X	ACI 318: 5.11-5.13	1910.9
9. Inspection of prestressed concrete: a. Application of prestressing forces. b. Grouting of bonded prestressing tendons in the seismic force-resisting system.	X X	—	ACI 318: 18.20 ACI 318: 18.18.4	—
10. Erection of precast concrete members.	—	X	ACI 318: Ch. 16	—
11. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 6.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 6.1.1	—
13. Inspection of adhesive anchors in horizontal and upwardly inclined positions. <sup>c</sup>	—	X	ACI 318: D.9.2.2	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1705.11, Special inspections for seismic resistance.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with ACI 355.2 or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

c. Installation of all adhesive anchors in horizontal and upwardly inclined positions shall be performed by an ACI/CRSI certified adhesive anchor installer.

*daily record of placements, identifying each truck, its load, and time of receipt, and approximate location of deposit in the structure and will transmit a copy of the daily record to the enforcement agency.*

#### **1705A.3.4 Inspection of prestressed concrete.**

*1. In addition to the general inspection required for concrete work, all plant fabrication of prestressed concrete members or tensioning of posttensioned members constructed at the site shall be continuously inspected by an inspector specially approved for this purpose by the enforcement agency.*

2. *The prestressed concrete plant fabrication inspector shall check the materials, equipment, tensioning procedure and construction of the prestressed members and prepare daily written reports. The inspector shall make a verified report identifying the members by mark and shall include such pertinent data as lot numbers of tendons used, tendon jacking forces, age and strength of concrete at time of tendon release and such other information that may be required.*
3. *The inspector of prestressed members posttensioned at the site shall check the condition of the prestressing tendons, anchorage assemblies and concrete in the area of the anchorage, the tensioning equipment and the tensioning procedure and prepare daily written reports. The inspector shall make a verified report of the prestressing operation identifying the members or tendons by mark and including such pertinent data as the initial cable slack, net elongation of tendons, jacking force developed, and such other information as may be required.*
4. *The verified reports of construction shall show that of the inspector's own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site posttensioning inspections the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure*

**1705A.3.5 Concrete preplacement inspection.** *Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the inspector of record.*

**1705A.3.6 Placing record.** *A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.*

**1705A.4 Masonry construction.** *Masonry construction shall be inspected and verified in accordance with TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6 quality assurance program, as set forth in Table 1.19.3, Level C requirements. Inspection and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17A and 19A*

**1705A.4.1 Glass unit masonry and masonry veneer in Risk Categories II, III, or IV.** *The minimum special inspection program for glass unit masonry or masonry veneer designed by Section 2110A or Chapter 14, respectively, in structures classified as Risk Categories II, III, or IV, in accordance with Section 1604A.5, shall comply*

with TMS 402/ACI 530/ASCE 5 Level B Quality Assurance.

**1705A.4.2 Vertical masonry foundation elements.** *Special inspection shall be performed in accordance with Section 1705.4 for vertical masonry foundation elements.*

**1705A.5 Wood construction.** *Special inspections of the fabrication process of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704A.2.5 except as modified in this section. Special inspections of site-built assemblies shall be in accordance with this section.*

**1705A.5.1 High-load diaphragms.** *High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704A.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved building plans. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved building plans.*

**1705A.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater.** *Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.*

**1705A.5.3 Wood structural elements and assemblies.** *Special inspection of wood structural elements and assemblies is required, as specified in this section, to ensure conformance with approved drawings and specifications, and applicable standards.*

*The special inspector shall furnish a verified report to the design professional in general responsible charge of construction observation, the structural engineer, and the enforcement agency, in accordance with the California Administrative Code and this chapter. The verified report shall list all inspected members or trusses, and shall indicate whether or not the inspected members or trusses conform with applicable standards and the approved drawings and specifications. Any nonconforming items shall be indicated on the verified report.*

**1705A.5.4 Structural glued laminated timber.** *Manufacture of all structural glued laminated timber shall be continuously inspected by a qualified special inspector approved by the enforcement agency.*

*The special inspector shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the special inspector with an identification mark.*

**Exception:** *Special Inspection is not required for non-custom members of 5<sup>1</sup>/<sub>8</sub> inch maximum width and 18 inch maximum depth, and with a maximum clear span*

of 32 feet, manufactured and marked in accordance with ANSI/AITC A 190.1 Section 6.1.1 for noncustom members.

**1705A.5.5 Manufactured open web trusses.** The manufacture of open web trusses shall be continuously inspected by a qualified special inspector approved by the enforcement agency.

The special inspector shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected truss shall be stamped with an identification mark by the special inspector.

**1705A.5.6 Timber connectors.** The installation of all split ring and shear plate timber connectors, and timber rivets shall be continuously inspected by a qualified inspector approved by the enforcement agency. The inspector shall furnish the architect, structural engineer and the enforcement agency with a report duly verified by him that the materials, timber connectors and workmanship conform to the approved plans and specifications.

**1705A.6 Soils.** Special inspections for existing site soil conditions, fill placement and load-bearing requirements shall be as required by this section and Table 1705A.6. The approved geotechnical report, and the construction documents prepared by the registered design professionals shall be used to determine compliance. During fill placement, the special inspector shall determine that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report.

**Exception:** Where Section 1803A does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.

**1705A.6.1 Soil fill.** All fills used to support the foundations of any building or structure shall be continuously inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of the geotechnical engineer to verify that fills meet the requirements of the approved construction documents and to coordinate all fill inspection and testing during the construction involving such fills.

The duties of the geotechnical engineer or his or her qualified representative shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill; inspection of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; the inspection or review of geotechnical drainage devices, buttress fills or other similar protective measures in accordance with the approved construction documents.

A verified report shall be submitted by the geotechnical engineer as required by the California Administrative Code. The report shall indicate that all tests and inspection required by the approved construction documents were completed and that the tested materials and/or inspected work meet the requirements of the approved construction documents.

**1705A.7 Driven deep foundations.** Special inspections shall be performed during installation and testing of driven deep foundation elements as required by Table 1705A.7. The approved instruction documents prepared by the registered design professionals, shall be used to determine compliance.

**1705A.7.1 Driven deep foundations observation.** The installation of driven deep foundations shall be continuously observed by a qualified representative of the geotechnical engineer responsible for that portion of the project.

The representative of the geotechnical engineer shall make a report of the deep foundation pile-driving operation giving such pertinent data as the physical characteristics of the deep foundation pile-driving equipment, identifying marks for each deep foundation pile, the total depth of embedment for each deep foundation; and when the allowable deep foundation pile loads are determined by a dynamic load formula, the design formula used, and the permanent penetration under the last 10 blows. One copy of the report shall be sent to the enforcement agency.

**1705A.8 Cast-in-place deep foundations.** Special inspections shall be performed during installation and testing of cast-in-place deep foundation elements as required by Table 1705.8. The approved geotechnical report, and the construction documents prepared by the registered design professionals, shall be used to determine compliance.

**TABLE 1705A.6  
REQUIRED VERIFICATION AND INSPECTION OF SOILS**

VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly.	—	X

**TABLE 1705A.7  
REQUIRED VERIFICATION AND INSPECTION OF DRIVEN DEEP FOUNDATION ELEMENTS**

VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Observe driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional inspections in accordance with Section 1705A.2.	—	—
6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705A.3.	—	—
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	—	—

**TABLE 1705.8  
REQUIRED VERIFICATION AND INSPECTION OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS**

VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODICALLY DURING TASK LISTED
1. Observe drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform additional inspections in accordance with Section 1705.3.	—	—

**1705A.9 Helical pile foundations.** Special inspections shall be performed continuously during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

**1705A.10 Special inspections for wind resistance.** Special inspections itemized in Sections 1705A.10.1 through 1705A.10.3, unless exempted by the exceptions to Section 1704A.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where  $V_{asd}$  as determined in accordance with Section 1609.3.1 is 120 miles per hour (52.8 m/sec) or greater.
2. In wind Exposure Category C or D, where  $V_{asd}$  as determined in accordance with Section 1609.3.1 is 110 mph (49 m/sec) or greater.

**1705A.10.1 Structural wood.** Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

**1705A.10.2 Cold-formed steel light-frame construction.** Periodic special inspection is required during welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**1705A.10.3 Wind-resisting components.** Periodic special inspection is required for the following systems and components:

1. Roof cladding.
2. Wall cladding.

**1705A.11 Special inspections for seismic resistance.** Special inspections itemized in Sections 1705A.11.1 through 1705A.11.8, unless exempted by the exceptions of Section 1704A.2, are required for the following:

1. The seismic force-resisting systems in structures assigned to Seismic Design Category D, E or F in accordance with Sections 1705A.11.1 through 1705A.11.3, as applicable.
2. *Equipment/components requiring special seismic certification* assigned to Seismic Design Category D, E or F in accordance with Section 1705A.11.4.
3. Architectural, mechanical and electrical components in accordance with Sections 1705A.11.5 and 1705A.11.6.
4. Storage racks in structures assigned to Seismic Design Category D, E or F in accordance with Section 1705A.11.7.
5. Seismic isolation *and damping* systems in accordance with Section 1705A.11.8.

**1705A.11.1 Structural steel.** Special inspection for structural steel shall be in accordance with the quality assurance requirements of AISC 341 *as modified by Section 1705A.2.1 of this code.*

**1705A.11.2 Structural wood.** Continuous special inspection is required during field gluing operations of elements of the seismic force-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

**1705A.11.3 Cold-formed steel light-frame construction.** Periodic special inspection is required during welding operations of elements of the seismic force-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**1705A.11.4 Special inspection for special seismic certification.** The special inspector shall examine *equipment and components* requiring *special seismic certification* in accordance with Section 1705A.12.4 and verify that the label, anchorage or mounting conforms to the certificate of compliance.

**1705A.11.5 Architectural components.** Periodic special inspection is required during the erection and fastening of exterior cladding, interior and exterior nonbearing walls, *ceilings*, and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

**1705A.11.5.1 Access floors.** Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

**1705A.11.6 Mechanical and electrical components.** Special inspection for mechanical and electrical components shall be as follows:

1. Periodic special inspection is required during the anchorage of electrical equipment for emergency or standby power systems in structures assigned to Seismic Design Category D, E or F;
2. Periodic special inspection is required during the anchorage of other electrical equipment in structures assigned to Seismic Design Category D, E or F;
3. Periodic special inspection is required during the installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category D, E or F;
4. Periodic special inspection is required during the installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category D, E or F; and
5. Periodic special inspection is required during the installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category D, E or F where the construction documents require a nominal clearance of  $\frac{1}{4}$  inch (6.4 mm) or less between the equipment support frame and restraint.

**1705A.11.7 Storage racks.** Periodic special inspection is required during the anchorage of storage racks 8 feet (2438 mm) or greater in height in structures assigned to Seismic Design Category D, E or F.

**1705A.11.8 Seismic isolation and damping systems.** Periodic special inspection shall be provided for seismic isolation systems during the fabrication and installation of isolator units and energy dissipation devices. *Continuous special inspection is required for prototype and production testing of isolator units and damping devices.*

**1705A.12 Testing and certification for seismic resistance.** The testing and *certification* specified in Sections 1705A.12.1 through 1705A.12.4, unless exempted from special inspections by the exceptions of Section 1704A.2 are required as follows:

1. The seismic force-resisting systems in structures assigned to Seismic Design Category D, E or F shall meet the requirements of Sections 1705A.12.1 and 1705A.12.2, as applicable.
2. *Equipment and components* in structures assigned to Seismic Design Category D, E or F shall comply with the *special seismic* certification requirements of Section 1705A.12.4.
3. Architectural, mechanical and electrical components in structures assigned to Seismic Design Category D, E or F and where the requirements of ASCE 7 Section 13.2.1, *Item 2*, are met by submittal of manufacturer's certification, shall comply with Section 1705A.12.3.
4. The seismic isolation system in seismically isolated structures and damping devices, shall meet the testing requirements of Section 1705A.12.5.

**1705A.12.1 Concrete reinforcement.** Where reinforcement complying with ASTM A 615 is used to resist earth-

quake-induced flexural and axial forces in special moment frames, special structural walls and coupling beams connecting special structural walls, in structures assigned to Seismic Design Category B, C, D, E or F, the reinforcement shall comply with Section 21.1.5.2 of ACI 318. Certified mill test reports shall be provided for each shipment of such reinforcement. Where reinforcement complying with ASTM A 615 is to be welded, chemical tests shall be performed to determine weldability in accordance with Section 3.5.2 of ACI 318.

**1705A.12.2 Structural steel.** Testing for structural steel shall be in accordance with the quality assurance requirements of AISC 341.

**Exception:** Testing for structural steel in structures assigned to Seismic Design Category C that are not specifically detailed for seismic resistance, with a response modification coefficient,  $R$ , of 3 or less, excluding cantilever column systems.

**1705A.12.3 Manufacturer's certification of nonstructural components.** The registered design professional shall specify on the construction documents the requirements for manufacturer's certification by analysis, testing or experience data for nonstructural components, in accordance with Section 13.2.1, Item 2 of ASCE 7, where such certification is required by Section 1705A.12.

*Seismic sway braces satisfying requirements of FM 1950 shall be deemed to satisfy the requirements of this Section.*

**1705A.12.4 Special seismic certification. [OSHPD 1 & 4]** The registered design professional shall specify on the construction documents the requirements for special seismic certification by analysis, testing or experience data for equipment and components listed in Section 1705A.12.4.1.

*Active or energized equipment and components shall be certified exclusively on the basis of approved shake table testing in accordance with ICC-ES AC 156.*

*Minimum of two equipment/components shall be tested for a product line with similar structural configuration. Where a range of products are tested, the two equipment/components shall be either the largest and smallest, or approved alternative representative equipment/components.*

**Exception:** When a single product (and not a product line with more than one product with variations) is certified and manufacturing process is ISO 9001 certified, one test shall be permitted.

*All tests shall be performed by an independent laboratory having accreditation to the International Standards Organization (ISO) accreditation standard 17025 or shall be under the responsible charge of an independent California licensed engineer. Test reports shall be reviewed and accepted by an independent California licensed structural engineer.*

*For a multicomponent system, where active or energized components are certified by tests, connecting elements, attachments, and supports can be justified by supporting analysis.*

**1705A.12.4.1** Special seismic certification shall be required for the following systems, equipment, and components:

1. Emergency and standby power systems.
2. Elevator equipment (excluding elevator cabs).
3. Components with hazardous contents.
4. Exhaust and smoke control fans.
5. Switchgear and switchboards.
6. Motor control centers.
7. Radiography and fluoroscopy systems in fluoroscopy rooms.
8. CT (Computerized Tomography) systems.
9. Air conditioning units.
10. Air handling units.
11. Chillers, evaporators, and condensers.
12. Cooling towers.
13. Transformers.
14. Electrical substations.
15. UPS and batteries.
16. Distribution panels.
17. Control panels.
18. Power isolation and correction systems.
19. Motorized surgical lighting systems.
20. Motorized operating table systems.

**Exceptions:**

1. Equipment and components weighing not more than 20 lbs. supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with this code.
2. Movable (mobile) and temporary equipment/components that are not anchored to structure or permanently attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "permanently attached" shall include all electrical connections except plugs for duplex receptacles.
3. Pipes, ducts, conduits and cable trays, excluding in-line equipment and components.
4. Underground tanks.
5. Electric motors and pumps not more than 10 hp rigidly supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with this code.

**1705A.12.5 Seismic isolation and damping systems.** Seismic isolation and damping systems shall be tested in accordance with Sections 17.8 and 18.9 of ASCE 7.

*Prototype and production testing and associated acceptance criteria for isolator units and damping devices shall be subject to preapproval by the building official. Testing exemption for similar units shall require approval by the building official.*

**1705A.13 Sprayed fire-resistant materials.** Special inspections for sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be in accordance with Sections 1705.13.1 through 1705.13.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, where applicable.

**1705A.13.1 Physical and visual tests.** The special inspections shall include the following tests and observations to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.
2. Thickness of application.
3. Density in pounds per cubic foot ( $\text{kg/m}^3$ ).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

**1705A.13.2 Structural member surface conditions.** The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected before the application of the sprayed fire-resistant material.

**1705A.13.3 Application.** The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

**1705A.13.4 Thickness.** No more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, but in no case less than the minimum allowable thickness required by Section 1705A.13.4.1.

**1705A.13.4.1 Minimum allowable thickness.** For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus  $\frac{1}{4}$  inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E 605. Samples of the sprayed

fire-resistant materials shall be selected in accordance with Sections 1705A.13.4.2 and 1705A.13.4.3.

**1705A.13.4.2 Floor, roof and wall assemblies.** The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E 605, making not less than four measurements for each 1,000 square feet (93  $\text{m}^2$ ) of the sprayed area, or portion thereof, in each story.

**1705A.13.4.3 Cellular decks.** Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. A minimum of four measurements shall be made, located symmetrically within the square area.

**1705A.13.4.4 Fluted decks.** Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. A minimum of four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

**1705A.13.4.5 Structural members.** The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E 605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

**1705A.13.4.6 Beams and girders.** At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

**1705A.13.4.7 Joists and trusses.** At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

**1705A.13.4.8 Wide-flanged columns.** At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

**1705A.13.4.9 Hollow structural section and pipe columns.** At hollow structural section and pipe columns, thickness measurements shall be made at a minimum of four locations around the column at each end of a 12-inch (305 mm) length.

**1705A.13.5 Density.** The density of the sprayed fire-resistant material shall not be less than the density specified in the approved fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E 605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232  $\text{m}^2$ ) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of struc-



tural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**1705A.13.6 Bond strength.** The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall not be less than 150 pounds per square foot (psf) (7.18 kN/m<sup>2</sup>). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E 736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705A.13.6.1 through 1705A.13.6.3.

**1705A.13.6.1 Floor, roof and wall assemblies.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) of the sprayed area, or portion thereof, in each story.

**1705A.13.6.2 Structural members.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**1705A.13.6.3 Primer, paint and encapsulant bond tests.** Bond tests to qualify a primer, paint or encapsulant shall be conducted when the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

**1705A.14 Mastic and intumescent fire-resistant coatings.** Special inspections for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be in accordance with AWCI 12-B. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents.

\* **1705A.15 Exterior insulation and finish systems (EIFS).** Special inspections shall be required for all EIFS applications.

**Exceptions:**

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

**1705A.15.1 Water-resistive barrier coating.** A water-resistive barrier coating complying with ASTM E 2570 requires special inspection of the water-resistive barrier coating when installed over a sheathing substrate.

**1705A.16 Fire-resistant penetrations and joints.** In high-rise buildings or in buildings assigned to Risk Category III or IV in accordance with Section 1604A.5, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems, and perimeter fire barrier systems that are tested and listed in accordance with Sections 714A.3.1.2, 714A.4.1.2, 715A.3 and 715A.4 shall be in accordance with Section 1705A.16.1 or 1705A.16.2.

**1705A.16.1 Penetration firestops.** Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714A.3.1.2 and 714A.4.1.2 shall be conducted by an approved inspection agency in accordance with ASTM E 2174.

**1705A.16.2 Fire-resistant joint systems.** Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715A.3 and 715A.4 shall be conducted by an approved inspection agency in accordance with ASTM E 2393.

**1705A.17 Special inspection for smoke control.** Smoke control systems shall be tested by a special inspector.

**1705A.17.1 Testing scope.** The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

**1705A.17.2 Qualifications.** Special inspection agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

**1705A.18 Shotcrete.** *All shotcrete work shall be continuously inspected during placing by an inspector specially approved for that purpose by the enforcement agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The inspector shall furnish a verified report that of his or her own personal knowledge the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications.*

**1705A.18.1 Visual examination for structural soundness of in-place shotcrete.** *Completed shotcrete work shall be checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.*

**Exception:** Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.

## SECTION 1706A DESIGN STRENGTHS OF MATERIALS

**1706A.1 Conformance to standards.** The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

**1706A.2 New materials.** For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707A.

## SECTION 1707A ALTERNATIVE TEST PROCEDURE

**1707A.1 General.** In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.

## SECTION 1708A TEST SAFE LOAD

**1708A.1 Where required.** Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1710A. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

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## SECTION 1709A IN-SITU LOAD TESTS

**1709A.1 General.** Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. If the structural assessment determines that the load-bearing

capacity is less than that required by the code, load tests shall be conducted in accordance with Section 1709A.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

**1709A.2 Test standards.** Structural components and assemblies shall be tested in accordance with the appropriate referenced standards. In the absence of a standard that contains an applicable load test procedure, the test procedure shall be developed by a registered design professional and approved. The test procedure shall simulate loads and conditions of application that the completed structure or portion thereof will be subjected to in normal use.

**1709A.3 In-situ load tests.** In-situ load tests shall be conducted in accordance with Section 1709A.3.1 or 1709A.3.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16A as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

**1709A.3.1 Load test procedure specified.** Where a referenced standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1709A.3.2 shall apply.

**1709A.3.2 Load test procedure not specified.** In the absence of applicable load test procedures contained within a standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic load-resisting system, the test load shall be equal to two times the unfactored design loads. The test load shall be left in place for a period of 24 hours. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604A.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

## SECTION 1710A PRECONSTRUCTION LOAD TESTS

**1710A.1 General.** In evaluating the physical properties of materials and methods of construction that are not capable of being designed by approved engineering analysis or do not comply with the applicable referenced standards, the structural adequacy shall be predetermined based on the load test criteria established in this section.

**1710A.2 Load test procedures specified.** Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1710A.3 shall apply.

**1710A.3 Load test procedures not specified.** Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1710A.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

**1710A.3.1 Test procedure.** The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1710A.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1710A.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in Section 1710A.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

**1710A.3.2 Deflection.** The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3.

**1710A.4 Wall and partition assemblies.** Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

**1710A.5 Exterior window and door assemblies.** The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1710A.5.1 or 1710A.5.2.

**Exception:** Structural wind load design pressures for window units smaller than the size tested in accordance with Section 1710A.5.1 or 1710A.5.2 shall be permitted to be

higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the small unit shall be the same as the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window unit having the highest allowable design pressure.

**1710A.5.1 Exterior windows and doors.** Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1710.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403A.2 and 2403A.3.

**1710A.5.2 Exterior windows and door assemblies not provided for in Section 1710A.5.1.** Exterior window and door assemblies shall be tested in accordance with ASTM E 330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E 330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

**1710A.6 Skylights and sloped glazing.** Unit skylights and tubular daylighting devices (TDDs) shall comply with the requirements of Section 2405. All other skylights and sloped glazing shall comply with the requirements of Chapter 24.

**1710A.7 Test specimens.** Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

## SECTION 1711A MATERIAL AND TEST STANDARDS

**1711A.1 Joist hangers.** Testing of joist hangers shall be in accordance with Sections 1711A.1.1 through 1711A.1.3, as applicable.

**1711A.1.1 General.** The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D 1761 using lumber having a specific gravity of 0.49 or greater, but not greater than 0.55, as determined in accordance with AF&PA NDS for the joist and headers.

**Exception:** The joist length shall not be required to exceed 24 inches (610 mm).

**1711A.1.2 Vertical load capacity for joist hangers.** The vertical load-bearing capacity for the joist hanger shall be determined by testing a minimum of three joist hanger assemblies as specified in ASTM D 1761. If the ultimate vertical load for any one of the tests varies more than 20 percent from the average ultimate vertical load, at least three additional tests shall be conducted. The allowable vertical load-bearing of the joist hanger shall be the lowest value determined from the following:

1. The lowest ultimate vertical load for a single hanger from any test divided by three (where three tests are conducted and each ultimate vertical load does not vary more than 20 percent from the average ultimate vertical load).
2. The average ultimate vertical load for a single hanger from all tests divided by three (where six or more tests are conducted).
3. The average from all tests of the vertical loads that produce a vertical movement of the joist with respect to the header of  $\frac{1}{8}$  inch (3.2 mm).
4. The sum of the allowable design loads for nails or other fasteners utilized to secure the joist hanger to the wood members and allowable bearing loads that contribute to the capacity of the hanger.
5. The allowable design load for the wood members forming the connection.

\*\*

**1711A.1.2.1 Design value modifications for joist hangers.** Allowable design values for joist hangers that are determined by Item 4 or 5 in Section 1711A.1.2 shall be permitted to be modified by the appropriate load duration factors as specified in AF&PA NDS but shall not exceed the direct loads as determined by Item 1, 2 or 3 in Section 1711A.1.2. Allowable design values determined by Item 1, 2 or 3 in Section 1711A.1.2 shall not be modified by load duration factors.

**1711A.1.3 Torsional moment capacity for joist hangers.** The torsional moment capacity for the joist hanger shall be determined by testing at least three joist hanger assemblies as specified in ASTM D 1761. The allowable torsional moment of the joist hanger shall be the average torsional moment at which the lateral movement of the top or bottom of the joist with respect to the original position of the joist is  $\frac{1}{8}$  inch (3.2 mm).

\*

**1711A.2 Concrete and clay roof tiles.** Testing of concrete and clay roof tiles shall be in accordance with Sections 1711A.2.1 and 1711A.2.2, as applicable.

**1711A.2.1 Overturning resistance.** Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with SBCCI SSTD 11 and Chapter 15.

**1711A.2.2 Wind tunnel testing.** Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11 and Chapter 15.

**Notation for [OSHDP]:**

**Authority:** Health and Safety Code Section 129850

**Reference:** Health and Safety Code Sections 1275, 129850 and 129790

**Notation for [DSA-SS]:**

**Authority:** Education Code Sections 17310 and 81142, and H&S Code Section 16022.

**Reference:** Education Code Sections 17280 through 17317, and 81130 through 81147, and Health and Safety Code Sections 16000 through 16023.

**Notation for [DSA-SS/CC]:**

**Authority:** Education Code Section 81053.

**Reference:** Education Code Sections 81052, 81053, and 81130 through 81147.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 18 – SOILS AND FOUNDATIONS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X										X									
<i>Adopt entire chapter as amended (amended sections listed below)</i>			X	X						X										
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
1801.2																				
1803.1.1– 1803.1.1.5			X	X																
1803.2										X										
1803.6										X										
1803.7										X										
1804.3.1			X	X																
1805.4.1			X	X																
1805.4.3			X	X																
1810.3.1.5.1										X										
1810.3.10.4.1										X										
1810.3.10.4	X		X	X																



## CHAPTER 18

## SOILS AND FOUNDATIONS

SECTION 1801  
GENERAL

**1801.1 Scope.** The provisions of this chapter shall apply to building and foundation systems.

**1801.2 Design basis.** Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in Section 1605.3. The quality and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16, 19, 21, 22 and 23 of this code. Excavations and fills shall also comply with Chapter 33.

- || **[HCD 1]** For limited-density owner-built rural dwellings, pier foundations, stone masonry footings and foundations, pressure-treated lumber, poles or equivalent foundation materials or designs may be used, provided that the bearing is sufficient for the purpose intended.

SECTION 1802  
DEFINITIONS

**1802.1 Definitions.** The following words and terms are defined in Chapter 2:

**DEEP FOUNDATION.**

**DRILLED SHAFT.**

Socketed drilled shaft.

**HELICAL PILE.**

**MICROPILE.**

**SHALLOW FOUNDATION.**

SECTION 1803  
GEOTECHNICAL INVESTIGATIONS

**1803.1 General.** Geotechnical investigations shall be conducted in accordance with Section 1803.2 and reported in accordance with Section 1803.6. Where required by the building official or where geotechnical investigations involve in-situ testing, laboratory testing or engineering calculations, such investigations shall be conducted by a registered design professional.

- > **1803.1.1 General and where required for applications listed in Section 1.8.2.1.1 regulated by the Department of Housing and Community Development.** [HCD 1] Foundation and soils investigations shall be conducted in conformance with Health and Safety Code Sections 17953 through 17957 as summarized below.

**1803.1.1.1 Preliminary soil report.** Each city, county, or city and county shall enact an ordinance which

requires a preliminary soil report, prepared by a civil engineer who is registered by the state. The report shall be based upon adequate test borings or excavations, of every subdivision, where a tentative and final map is required pursuant to Section 66426 of the Government Code.

The preliminary soil report may be waived if the building department of the city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, shall determine that, due to the knowledge such department has as to the soil qualities of the soil of the subdivision or lot, no preliminary analysis is necessary.

**1803.1.1.2 Soil investigation by lot, necessity, preparation, and recommendations.** If the preliminary soil report indicates the presence of critically expansive soils or other soil problems which, if not corrected, would lead to structural defects, such ordinance shall require a soil investigation of each lot in the subdivision.

The soil investigation shall be prepared by a civil engineer who is registered in this state. It shall recommend corrective action which is likely to prevent structural damage to each dwelling proposed to be constructed on the expansive soil.

**1803.1.1.3 Approval, building permit conditions, appeal.** The building department of each city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, shall approve the soil investigation if it determines that the recommended action is likely to prevent structural damage to each dwelling to be constructed. As a condition to the building permit, the ordinance shall require that the approved recommended action be incorporated in the construction of each dwelling. Appeal from such determination shall be to the local appeals board.

**1803.1.1.4 Liability.** A city, county, city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, is not liable for any injury which arises out of any act or omission of the city, county, city and county, other enforcement agency, or a public employee or any other person under Section 1803.1.1.

**1803.1.1.5. Alternate procedures.** The governing body of any city, county, or city and county may enact an ordinance prescribing an alternate procedure which is equal to or more restrictive than the procedure specified in Section 1803.1.1.



**1803.2 Investigations required.** Geotechnical investigations shall be conducted in accordance with Sections 1803.3 through 1803.5.

**Exception:** The building official shall be permitted to waive the requirement for a geotechnical investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in Sections 1803.5.1 through 1803.5.6 and Sections 1803.5.10 and 1803.5.11.

*[OSHPD 2] Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type V construction and 4,000 square feet (371 m<sup>2</sup>) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS). Allowable foundation and lateral soil pressure values may be determined from Table 1806.2.*

**1803.3 Basis of investigation.** Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

**1803.3.1 Scope of investigation.** The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

**1803.4 Qualified representative.** The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

**1803.5 Investigated conditions.** Geotechnical investigations shall be conducted as indicated in Sections 1803.5.1 through 1803.5.12.

**1803.5.1 Classification.** Soil materials shall be classified in accordance with ASTM D 2487.

**1803.5.2 Questionable soil.** Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

**1803.5.3 Expansive soil.** In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D 4318.

2. More than 10 percent of the soil particles pass a No. 200 sieve (75  $\mu$ m), determined in accordance with ASTM D 422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion index greater than 20, determined in accordance with ASTM D 4829.

**1803.5.4 Ground-water table.** A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

**Exception:** A subsurface soil investigation to determine the location of the ground-water table shall not be required where waterproofing is provided in accordance with Section 1805.

**1803.5.5 Deep foundations.** Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data upon which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.
2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

**1803.5.6 Rock strata.** Where subsurface explorations at the project site indicate variations or doubtful characteristics in the structure of the rock upon which foundations are to be constructed, a sufficient number of borings shall be made to a depth of not less than 10 feet (3048 mm) below the level of the foundations to provide assurance of the soundness of the foundation bed and its load-bearing capacity.

**1803.5.7 Excavation near foundations.** Where excavation will remove lateral support from any foundation, an investigation shall be conducted to assess the potential consequences and address mitigation measures.

**1803.5.8 Compacted fill material.** Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.

2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

#### **1803.5.9 Controlled low-strength material (CLSM).**

Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

**1803.5.10 Alternate setback and clearance.** Where setbacks or clearances other than those required in Section 1808.7 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1808.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

**1803.5.11 Seismic Design Categories C through F.** For structures assigned to Seismic Design Category C, D, E or F, a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

**1803.5.12 Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, the geotechnical investigation required by Section 1803.5.11 shall also include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude, and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on:
  - 2.1 A site-specific study in accordance with Section 21.5 of ASCE 7; or
  - 2.2 In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss, including, but not limited to:
  - 3.1. Estimation of total and differential settlement;
  - 3.2. Lateral soil movement;
  - 3.3. Lateral soil loads on foundations;
  - 3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction;
  - 3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations;
  - 3.6. Increases in soil lateral pressures on retaining walls; and
  - 3.7. Flotation of buried structures.
4. Discussion of mitigation measures such as, but not limited to:
  - 4.1. Selection of appropriate foundation type and depths;
  - 4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces;
  - 4.3. Ground stabilization; or
  - 4.4. Any combination of these measures and how they shall be considered in the design of the structure.

**1803.6 Reporting.** Where geotechnical investigations are required, a written report of the investigations shall be submitted to the building official by the owner or authorized agent at the time of permit application. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the

effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.

6. Expected total and differential settlement.
7. Deep foundation information in accordance with Section 1803.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803.5.9.
11. **[OSHPD 2]** *The report shall consider the effects of seismic hazard in accordance with Section 1803.7.*

> || **1803.7 Geohazard reports.** **[OSHPD 2]** *Geohazard reports shall be required for all proposed construction.*

**Exceptions:**

1. *Reports are not required for one-story, wood-frame and light-steel-frame buildings of Type V construction and 4,000 square feet (371 m<sup>2</sup>) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS); nonstructural, associated structural or voluntary structural alterations and incidental structural additions or alterations, and structural repairs for other than earthquake damage.*
2. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

|| *The purpose of the geohazard report shall be to identify geologic and seismic conditions that may require project mitigations. The reports shall contain data which provide an assessment of the nature of the site and potential for earthquake damage based on appropriate investigations of the regional and site geology, project foundation conditions and the potential seismic shaking at the site. The report shall be prepared by a California-certified engineering geologist in consultation with a California-registered geotechnical engineer.*

|| *The preparation of the geohazard report shall consider the most recent CGS Note 48; Checklist for the Review of Engineering Geology and Seismology Reports for California Public School, Hospitals, and Essential Services Buildings. In addition, the most recent version of CGS Special Publication 42, Fault Rupture Hazard Zones in California, shall be considered for project sites proposed within an Alquist-Priolo Earthquake Fault Zone. The most recent version of CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, shall be considered for project sites proposed within a Seismic Hazard Zone. All conclusions shall be fully supported by satisfactory data and analysis.*

*In addition to requirements in Sections 1803.5.11 and 1803.5.12, the report shall include, but shall not be limited to, the following:*

1. *Site geology.*
2. *Evaluation of the known active and potentially active faults, both regional and local.*
3. *Ground-motion parameters, as required by Section 1613 and ASCE 7.*

## SECTION 1804 EXCAVATION, GRADING AND FILL

**1804.1 Excavation near foundations.** Excavation for any purpose shall not remove lateral support from any foundation without first underpinning or protecting the foundation against settlement or lateral translation.

**1804.2 Placement of backfill.** The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

**Exception:** CLSM need not be compacted.

**1804.3 Site grading.** The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped a minimum of 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

**Exception:** Where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than one unit vertical in 48 units horizontal (2-percent slope).

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

**1804.3.1 [HCD 1] Construction plans.** *Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.1.*

**1804.4 Grading and fill in flood hazard areas.** In flood hazard areas established in Section 1612.3, grading and/or fill shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of flood water and, as applicable, wave action.

2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In flood hazard areas subject to high-velocity wave action, unless such fill is conducted and/or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed flood hazard area encroachment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point.

**1804.5 Compacted fill material.** Where shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803.

**Exception:** Compacted fill material 12 inches (305 mm) in depth or less need not comply with an approved report, provided the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557. The compaction shall be verified by special inspection in accordance with Section 1705.6.

**1804.6 Controlled low-strength material (CLSM).** Where shallow foundations will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803.

## SECTION 1805 DAMPPROOFING AND WATERPROOFING

**1805.1 General.** Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1203.4.

**1805.1.1 Story above grade plane.** Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1805.2 and a foundation drain shall be installed in accordance with Section 1805.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803.5.4, 1805.3 and 1805.4.1 shall not apply in this case.

**1805.1.2 Under-floor space.** The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803.5.4, 1805.2, 1805.3 and 1805.4 shall not apply in this case.

**1805.1.2.1 Flood hazard areas.** For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on at least one side.

**Exception:** Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA/FIA-TB-11.

**1805.1.3 Ground-water control.** Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1805.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

**1805.2 Dampproofing.** Where hydrostatic pressure will not occur as determined by Section 1803.5.4, floors and walls for other than wood foundation systems shall be dampproofed in accordance with this section. Wood foundation systems shall be constructed in accordance with AF&PA PWF.

**1805.2.1 Floors.** Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805.2.2 Walls.** Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m<sup>2</sup>) of acrylic modified cement,  $\frac{1}{8}$  inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887, any of the materials permit-

ted for waterproofing by Section 1805.3.2 or other approved methods or materials.

**1805.2.2.1 Surface preparation of walls.** Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than  $\frac{3}{8}$  inch (9.5 mm) of Portland cement mortar. The parging shall be coved at the footing.

**Exception:** Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

**1805.3 Waterproofing.** Where the ground-water investigation required by Section 1803.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805.1.3, walls and floors shall be waterproofed in accordance with this section.

**1805.3.1 Floors.** Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805.3.2 Walls.** Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805.3.2.1 Surface preparation of walls.** Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805.2.2.1.

**1805.3.3 Joints and penetrations.** Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made water-tight utilizing approved methods and materials.

**1805.4 Subsoil drainage system.** Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805.1.3 shall be deemed adequate for lowering the ground-water table.

**1805.4.1 Floor base course.** Floors of basements, except as provided for in Section 1805.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

**Exceptions:**

1. Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.
2. *[HCDI] When a capillary break is installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

**1805.4.2 Foundation drain.** A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend a minimum of 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

**1805.4.3 Drainage discharge.** The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *California Plumbing Code*.

**Exception:** Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

## SECTION 1806

### PRESUMPTIVE LOAD-BEARING VALUES OF SOILS

**1806.1 Load combinations.** The presumptive load-bearing values provided in Table 1806.2 shall be used with the allowable stress design load combinations specified in Section 1605.3. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806.2 shall be permitted to be increased by one-third where used with the alternative

basic load combinations of Section 1605.3.2 that include wind or earthquake loads.

**1806.2 Presumptive load-bearing values.** The load-bearing values used in design for supporting soils near the surface shall not exceed the values specified in Table 1806.2 unless data to substantiate the use of higher values are submitted and approved. Where the building official has reason to doubt the classification, strength or compressibility of the soil, the requirements of Section 1803.5.2 shall be satisfied.

Presumptive load-bearing values shall apply to materials with similar physical characteristics and dispositions. Mud, organic silt, organic clays, peat or unprepared fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

**Exception:** A presumptive load-bearing capacity shall be permitted to be used where the building official deems the load-bearing capacity of mud, organic silt or unprepared fill is adequate for the support of lightweight or temporary structures.

**1806.3 Lateral load resistance.** Where the presumptive values of Table 1806.2 are used to determine resistance to lateral loads, the calculations shall be in accordance with Sections 1806.3.1 through 1806.3.4.

**1806.3.1 Combined resistance.** The total resistance to lateral loads shall be permitted to be determined by combining the values derived from the lateral bearing pressure and the lateral sliding resistance specified in Table 1806.2.

**1806.3.2 Lateral sliding resistance limit.** For clay, sandy clay, silty clay, clayey silt, silt and sandy silt, in no case shall the lateral sliding resistance exceed one-half the dead load.

**1806.3.3 Increase for depth.** The lateral bearing pressures specified in Table 1806.2 shall be permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a maximum of 15 times the tabular value.

**1806.3.4 Increase for poles.** Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a  $\frac{1}{2}$  inch (12.7 mm)

motion at the ground surface due to short-term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values.

## SECTION 1807 FOUNDATION WALLS, RETAINING WALLS AND EMBEDDED POSTS AND POLES

**1807.1 Foundation walls.** Foundation walls shall be designed and constructed in accordance with Sections 1807.1.1 through 1807.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808.

**1807.1.1 Design lateral soil loads.** Foundation walls shall be designed for the lateral soil loads set forth in Section 1610.

**1807.1.2 Unbalanced backfill height.** Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

**1807.1.3 Rubble stone foundation walls.** Foundation walls of rough or random rubble stone shall not be less than 16 inches (406 mm) thick. Rubble stone shall not be used for foundation walls of structures assigned to Seismic Design Category C, D, E or F.

**1807.1.4 Permanent wood foundation systems.** Permanent wood foundation systems shall be designed and installed in accordance with AF&PA PWF. Lumber and plywood shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2) and shall be identified in accordance with Section 2303.1.8.1.

TABLE 1806.2  
PRESUMPTIVE LOAD-BEARING VALUES

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction <sup>a</sup>	Cohesion (psf) <sup>b</sup>
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and/or gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806.3.2.

**1807.1.5 Concrete and masonry foundation walls.** Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21, as applicable.

**Exception:** Concrete and masonry foundation walls shall be permitted to be designed and constructed in accordance with Section 1807.1.6.

**1807.1.6 Prescriptive design of concrete and masonry foundation walls.** Concrete and masonry foundation walls that are laterally supported at the top and bottom shall be permitted to be designed and constructed in accordance with this section.

**1807.1.6.1 Foundation wall thickness.** The thickness of prescriptively designed foundation walls shall not be less than the thickness of the wall supported, except that foundation walls of at least 8-inch (203 mm) nominal width shall be permitted to support brick-veneered frame walls and 10-inch-wide (254 mm) cavity walls provided the requirements of Section 1807.1.6.2 or 1807.1.6.3 are met.

**1807.1.6.2 Concrete foundation walls.** Concrete foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.2.
2. The size and spacing of vertical reinforcement shown in Table 1807.1.6.2 is based on the use of reinforcement with a minimum yield strength of 60,000 pounds per square inch (psi) (414 MPa). Vertical reinforcement with a minimum yield strength of 40,000 psi (276 MPa) or 50,000 psi (345 MPa) shall be permitted, provided the same size bar is used and the spacing shown in the table is reduced by multiplying the spacing by 0.67 or 0.83, respectively.
3. Vertical reinforcement, when required, shall be placed nearest the inside face of the wall a distance,  $d$ , from the outside face (soil face) of the wall. The distance,  $d$ , is equal to the wall thickness,  $t$ , minus 1.25 inches (32 mm) plus one-half

**TABLE 1807.1.6.2  
CONCRETE FOUNDATION WALLS<sup>b, c</sup>**

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>a</sup> (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)								
		Design lateral soil load <sup>a</sup> (psf per foot of depth)								
		30 <sup>d</sup>			45 <sup>d</sup>			60		
		Minimum wall thickness (inches)								
		7.5	9.5	11.5	7.5	9.5	11.5	7.5	9.5	11.5
5	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
6	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	PC	PC	PC
7	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 48	PC	PC
	7	PC	PC	PC	#5 at 46	PC	PC	#6 at 48	PC	PC
8	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 43	PC	PC
	7	PC	PC	PC	#5 at 41	PC	PC	#6 at 43	PC	PC
	8	#5 at 47	PC	PC	#6 at 43	PC	PC	#6 at 32	#6 at 44	PC
9	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 39	PC	PC
	7	PC	PC	PC	#5 at 37	PC	PC	#6 at 38	#5 at 37	PC
	8	#5 at 41	PC	PC	#6 at 38	#5 at 37	PC	#7 at 39	#6 at 39	#4 at 48
	9 <sup>d</sup>	#6 at 46	PC	PC	#7 at 41	#6 at 41	PC	#7 at 31	#7 at 41	#6 at 39
10	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 37	PC	PC
	7	PC	PC	PC	#6 at 48	PC	PC	#6 at 35	#6 at 48	PC
	8	#5 at 38	PC	PC	#7 at 47	#6 at 47	PC	#7 at 35	#7 at 47	#6 at 45
	9 <sup>d</sup>	#6 at 41	#4 at 48	PC	#7 at 37	#7 at 48	#4 at 48	#6 at 22	#7 at 37	#7 at 47
	10 <sup>d</sup>	#7 at 45	#6 at 45	PC	#7 at 31	#7 at 40	#6 at 38	#6 at 22	#7 at 30	#7 at 38

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.2.

c. "PC" means plain concrete.

d. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable (see Section 1610).

e. For height of unbalanced backfill, see Section 1807.1.2.

the bar diameter,  $d_b$ , [ $d = t - (1.25 + d_b / 2)$ ]. The reinforcement shall be placed within a tolerance of  $\pm 3/8$  inch (9.5 mm) where  $d$  is less than or equal to 8 inches (203 mm) or  $\pm 1/2$  inch (12.7 mm) where  $d$  is greater than 8 inches (203 mm).

4. In lieu of the reinforcement shown in Table 1807.1.6.2, smaller reinforcing bar sizes with closer spacings that provide an equivalent cross-sectional area of reinforcement per unit length shall be permitted.
5. Concrete cover for reinforcement measured from the inside face of the wall shall not be less than  $3/4$  inch (19.1 mm). Concrete cover for reinforcement measured from the outside face of the wall shall not be less than  $1 1/2$  inches (38 mm) for No. 5 bars and smaller, and not less than 2 inches (51 mm) for larger bars.
6. Concrete shall have a specified compressive strength,  $f'_c$ , of not less than 2,500 psi (17.2 MPa).
7. The unfactored axial load per linear foot of wall shall not exceed  $1.2 t f'_c$  where  $t$  is the specified wall thickness in inches.

**1807.1.6.2.1 Seismic requirements.** Based on the seismic design category assigned to the structure in accordance with Section 1613, concrete foundation walls designed using Table 1807.1.6.2 shall be subject to the following limitations:

1. Seismic Design Categories A and B. Not less than one No. 5 bar shall be provided around

window, door and similar sized openings. The bar shall be anchored to develop  $f_y$  in tension at the corners of openings.

2. Seismic Design Categories C, D, E and F. Tables shall not be used except as allowed for plain concrete members in Section 1905.1.8.

**1807.1.6.3 Masonry foundation walls.** Masonry foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.3(1) for plain masonry walls or Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4) for masonry walls with reinforcement.
2. Vertical reinforcement shall have a minimum yield strength of 60,000 psi (414 MPa).
3. The specified location of the reinforcement shall equal or exceed the effective depth distance,  $d$ , noted in Tables 1807.1.6.3(2), 1807.1.6.3(3) and 1807.1.6.3(4) and shall be measured from the face of the exterior (soil) side of the wall to the center of the vertical reinforcement. The reinforcement shall be placed within the tolerances specified in TMS 602/ACI 530.1/ASCE 6, Article 3.4.B.8 of the specified location.
4. Grout shall comply with Section 2103.13.
5. Concrete masonry units shall comply with ASTM C 90.
6. Clay masonry units shall comply with ASTM C 652 for hollow brick, except compliance with

**TABLE 1807.1.6.3(1)**  
**PLAIN MASONRY FOUNDATION WALLS<sup>a, b, c</sup>**

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>e</sup> (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		Design lateral soil load <sup>a</sup> (psf per foot of depth)		
		30 <sup>f</sup>	45 <sup>f</sup>	60
7	4 (or less)	8	8	8
	5	8	10	10
	6	10	12	10 (solid <sup>c</sup> )
	7	12	10 (solid <sup>c</sup> )	10 (solid <sup>c</sup> )
8	4 (or less)	8	8	8
	5	8	10	12
	6	10	12	12 (solid <sup>c</sup> )
	7	12	12 (solid <sup>c</sup> )	Note d
9	8	10 (solid <sup>c</sup> )	12 (solid <sup>c</sup> )	Note d
	4 (or less)	8	8	8
	5	8	10	12
	6	12	12	12 (solid <sup>c</sup> )
9	7	12 (solid <sup>c</sup> )	12 (solid <sup>c</sup> )	Note d
	8	12 (solid <sup>c</sup> )	Note d	Note d
	9 <sup>f</sup>	Note d	Note d	Note d

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. Solid grouted hollow units or solid masonry units.

d. A design in compliance with Chapter 21 or reinforcement in accordance with Table 1807.1.6.3(2) is required.

e. For height of unbalanced backfill, see Section 1807.1.2.

f. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable (see Section 1610).



ASTM C 62 or ASTM C 216 shall be permitted where solid masonry units are installed in accordance with Table 1807.1.6.3(1) for plain masonry.

7. Masonry units shall be laid in running bond and installed with Type M or S mortar in accordance with Section 2103.9.
8. The unfactored axial load per linear foot of wall shall not exceed  $1.2 t f'_m$  where  $t$  is the specified wall thickness in inches and  $f'_m$  is the specified compressive strength of masonry in pounds per square inch.
9. At least 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.
10. Corbeling of masonry shall be in accordance with Section 2104.2. Where an 8-inch (203 mm) wall is corbelled, the top corbel shall not

extend higher than the bottom of the floor framing and shall be a full course of headers at least 6 inches (152 mm) in length or the top course bed joint shall be tied to the vertical wall projection. The tie shall be W2.8 (4.8 mm) and spaced at a maximum horizontal distance of 36 inches (914 mm). The hollow space behind the corbelled masonry shall be filled with mortar or grout.

**1807.1.6.3.1 Alternative foundation wall reinforcement.** In lieu of the reinforcement provisions for masonry foundation walls in Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (mm) of wall shall be permitted to be used, provided the spacing of reinforcement does not exceed 72 inches (1829 mm) and reinforcing bar sizes do not exceed No. 11.

**TABLE 1807.1.6.3(2)**  
**8-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE  $d \geq 5$  INCHES<sup>a, b, c</sup>**

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>d</sup> (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load <sup>a</sup> (psf per foot of depth)		
		30°	45°	60
7-4	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#4 at 48
	6-0	#4 at 48	#5 at 48	#5 at 48
	7-4	#5 at 48	#6 at 48	#7 at 48
8-0	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#4 at 48
	6-0	#4 at 48	#5 at 48	#5 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
8-8	8-0	#5 at 48	#6 at 48	#7 at 48
	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
9-4	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#6 at 48	#7 at 48	#8 at 48
	8-8°	#6 at 48	#7 at 48	#8 at 48
	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
10-0	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#6 at 48	#7 at 48	#8 at 48
10-0	9-0°	#7 at 48	#8 at 48	#9 at 48
	10-0°	#7 at 48	#9 at 48	#9 at 48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. For alternative reinforcement, see Section 1807.1.6.3.1

d. For height of unbalanced backfill, see Section 1807.1.2

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

**TABLE 1807.1.6.3(3)**  
**10-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE  $d \geq 6.75$  INCHES<sup>a, b, c</sup>**

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>d</sup> (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load <sup>a</sup> (psf per foot of depth)		
		30°	45°	60
7-4	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-4	#4 at 56	#5 at 56	#6 at 56
8-0	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
	8-0	#5 at 56	#6 at 56	#7 at 56
8-8	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
	8-8 <sup>e</sup>	#5 at 56	#7 at 56	#8 at 56
9-4	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#5 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
	8-0	#5 at 56	#6 at 56	#7 at 56
	9-4 <sup>e</sup>	#6 at 56	#7 at 56	#7 at 56
10-0	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#5 at 56	#5 at 56
	7-0	#5 at 56	#6 at 56	#7 at 56
	8-0	#5 at 56	#7 at 56	#8 at 56
	9-0 <sup>e</sup>	#6 at 56	#7 at 56	#9 at 56
	10-0 <sup>e</sup>	#7 at 56	#8 at 56	#9 at 56

For SI: 1 inch = 25.4 mm, 1 foot = 304.8, 1 pound per square foot per foot = 1.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3

c. For alternative reinforcement, see Section 1807.1.6.3.1.

d. For height of unbalanced backfill, See Section 1807.1.2.

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

**TABLE 1807.1.6.3(4)**  
**12-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE  $d \geq 8.75$  INCHES<sup>a, b, c</sup>**

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT <sup>d</sup> (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load <sup>a</sup> (psf per foot of depth)		
		30°	45°	60°
7-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-4	#4 at 72	#5 at 72	#6 at 72
8-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
8-8	8-0	#5 at 72	#6 at 72	#8 at 72
	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
9-4	7-0	#4 at 72	#5 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#7 at 72
	9-4 <sup>e</sup>	#6 at 72	#7 at 72	#8 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#7 at 72
	9-0 <sup>e</sup>	#6 at 72	#7 at 72	#8 at 72
	10-0 <sup>e</sup>	#7 at 72	#8 at 72	#9 at 72

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. For alternative reinforcement, see Section 1807.1.6.3.1.

d. For height of unbalanced backfill, see Section 1807.1.2.

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

**1807.1.6.3.2 Seismic requirements.** Based on the seismic design category assigned to the structure in accordance with Section 1613, masonry foundation walls designed using Tables 1807.1.6.3(1) through 1807.1.6.3(4) shall be subject to the following limitations:

1. Seismic Design Categories A and B. No additional seismic requirements.
2. Seismic Design Category C. A design using Tables 1807.1.6.3(1) through 1807.1.6.3(4) is subject to the seismic requirements of Section 1.18.4.3 of TMS 402/ACI 530/ASCE 5.
3. Seismic Design Category D. A design using Tables 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 1.18.4.4 of TMS 402/ACI 530/ASCE 5.
4. Seismic Design Categories E and F. A design using Tables 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic require-

ments of Section 1.18.4.5 of TMS 402/ACI 530/ASCE 5.

**1807.2 Retaining walls.** Retaining walls shall be designed in accordance with Sections 1807.2.1 through 1807.2.3.

**1807.2.1 General.** Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, lateral soil pressures on both sides of the keyway shall be considered in the sliding analysis.

**1807.2.2 Design lateral soil loads.** Retaining walls shall be designed for the lateral soil loads set forth in Section 1610.

**1807.2.3 Safety factor.** Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605 shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 1.0 times other nomi-

nal loads, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

**Exception:** Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

**1807.3 Embedded posts and poles.** Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807.3.1 through 1807.3.3.

**1807.3.1 Limitations.** The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWP A U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

**1807.3.2 Design criteria.** The depth to resist lateral loads shall be determined using the design criteria established in Sections 1807.3.2.1 through 1807.3.2.3, or by other methods approved by the building official.

**1807.3.2.1 Nonconstrained.** The following formula shall be used in determining the depth of embedment required to resist lateral loads where no lateral constraint is provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where no lateral constraint is provided above the ground surface, such as by a structural diaphragm.

$$d = 0.5A \{ 1 + [1 + (4.36h/A)]^{1/2} \} \quad (\text{Equation 18-1})$$

where:

$$A = 2.34P/(S_1 b)$$

$b$  = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

$d$  = Depth of embedment in earth in feet (m) but not over 12 feet (3.658 m) for purpose of computing lateral pressure.

$h$  = Distance in feet (m) from ground surface to point of application of "P."

$P$  = Applied lateral force in pounds (kN).

$S_1$  = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

**1807.3.2.2 Constrained.** The following formula shall be used to determine the depth of embedment required

to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or pavement.

$$d = \sqrt{\frac{4.25Ph}{S_3 b}} \quad (\text{Equation 18-2})$$

or alternatively

$$d = \sqrt{\frac{4.25M_g}{S_3 b}} \quad (\text{Equation 18-3})$$

where:

$M_g$  = Moment in the post at grade, in foot-pounds (kN-m).

$S_3$  = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

**1807.3.2.3 Vertical load.** The resistance to vertical loads shall be determined using the vertical foundation pressure set forth in Table 1806.2.

**1807.3.3 Backfill.** The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with a specified compressive strength of not less than 2,000 psi (13.8 MPa). The hole shall not be less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

## SECTION 1808 FOUNDATIONS

**1808.1 General.** Foundations shall be designed and constructed in accordance with Sections 1808.2 through 1808.9. Shallow foundations shall also satisfy the requirements of Section 1809. Deep foundations shall also satisfy the requirements of Section 1810.

**1808.2 Design for capacity and settlement.** Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808.6.

**1808.3 Design loads.** Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 1605.2 or 1605.3. The dead load is permitted to include the weight of foundations and overlying fill. Reduced live loads, as specified in Sections 1607.10 and 1607.12, shall be permitted to be used in the design of foundations.

**1808.3.1 Seismic overturning.** Where foundations are proportioned using the load combinations of Section 1605.2 or 1605.3.1, and the computation of seismic overturning effects is by equivalent lateral force analysis or modal analysis, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

**1808.4 Vibratory loads.** Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

**1808.5 Shifting or moving soils.** Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

**1808.6 Design for expansive soils.** Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808.6.1 or 1808.6.2.

**Exception:** Foundation design need not comply with Section 1808.6.1 or 1808.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808.6.3; or
2. The building official approves stabilization of the soil in accordance with Section 1808.6.4.

**1808.6.1 Foundations.** Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

**1808.6.2 Slab-on-ground foundations.** Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* or *PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils*. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *PTI Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils*. It shall be permitted to analyze and design such slabs by

other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

**1808.6.3 Removal of expansive soil.** Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804.5 or 1804.6.

**Exception:** Expansive soil need not be removed to the depth of constant moisture, provided the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

**1808.6.4 Stabilization.** Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

**1808.7 Foundations on or adjacent to slopes.** The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808.7.1 through 1808.7.5.

**1808.7.1 Building clearance from ascending slopes.** In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808.7.5 and Figure 1808.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

**1808.7.2 Foundation setback from descending slope surface.** Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Except as provided for in Section 1808.7.5 and Figure 1808.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

**1808.7.3 Pools.** The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet

(2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

**1808.7.4 Foundation elevation.** On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device a minimum of 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

**1808.7.5 Alternate setback and clearance.** Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official shall be permitted to require a geotechnical investigation as set forth in Section 1803.5.10.

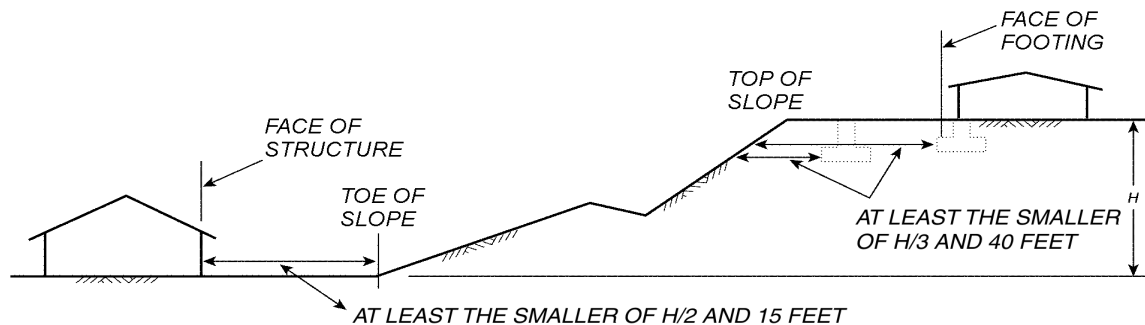
**1808.8 Concrete foundations.** The design, materials and construction of concrete foundations shall comply with Sections 1808.8.1 through 1808.8.6 and the provisions of Chapter 19.

**Exception:** Where concrete footings supporting walls of light-frame construction are designed in accordance with Table 1809.7, a specific design in accordance with Chapter 19 is not required.

**1808.8.1 Concrete or grout strength and mix proportioning.** Concrete or grout in foundations shall have a specified compressive strength ( $f'_c$ ) not less than the largest applicable value indicated in Table 1808.8.1.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

**1808.8.2 Concrete cover.** The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be no less than the largest applicable value specified in Table 1808.8.2. Longitudinal bars spaced less than  $1\frac{1}{2}$  inches (38 mm) clear distance apart shall be considered bundled bars for which the concrete cover provided shall also be no less than that required by Section 7.7.4 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered the concrete surface.



For SI: 1 foot = 304.8 mm.

**FIGURE 1808.7.1**  
**FOUNDATION CLEARANCES FROM SLOPES**

**TABLE 1808.8.1**  
**MINIMUM SPECIFIED COMPRESSIVE STRENGTH  $f'_c$  OF CONCRETE OR GROUT**

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, $f'_c$
1. Foundations for structures assigned to Seismic Design Category A, B or C	2,500 psi
2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to Seismic Design Category D, E or F	2,500 psi
2b. Foundations for other structures assigned to Seismic Design Category D, E or F	3,000 psi
3. Precast nonprestressed driven piles	4,000 psi
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

**TABLE 1808.8.2  
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 7.7 of ACI 318
2. Precast nonprestressed deep foundation elements	
Exposed to seawater	3 inches
Not manufactured under plant conditions	2 inches
Manufactured under plant control conditions	In accordance with Section 7.7.3 of ACI 318
3. Precast prestressed deep foundation elements	
Exposed to seawater	2.5 inches
Other	In accordance with Section 7.7.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

**1808.8.3 Placement of concrete.** Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

**1808.8.4 Protection of concrete.** Concrete foundations shall be protected from freezing during depositing and for a period of not less than five days thereafter. Water shall not be allowed to flow through the deposited concrete.

**1808.8.5 Forming of concrete.** Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Chapter 6 of ACI 318.

**1808.8.6 Seismic requirements.** See Section 1908 for additional requirements for foundations of structures assigned to Seismic Design Category C, D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of ACI 318, Sections 21.12.1 through 21.12.4, shall apply where not in conflict with the provisions of Sections 1808 through 1810.

**Exceptions:**

1. Detached one- and two-family dwellings of light-frame construction and two stories or less above grade plane are not required to comply with the provisions of ACI 318, Sections 21.12.1 through 21.12.4.

2. Section 21.12.4.4(a) of ACI 318 shall not apply.

**1808.9 Vertical masonry foundation elements.** Vertical masonry foundation elements that are not foundation piers as defined in Section 202 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402/ACI 530/ASCE 5.

## SECTION 1809 SHALLOW FOUNDATIONS

**1809.1 General.** Shallow foundations shall be designed and constructed in accordance with Sections 1809.2 through 1809.13.

**1809.2 Supporting soils.** Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804.5. CLSM shall be placed in accordance with Section 1804.6.

**1809.3 Stepped footings.** The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than one unit vertical in 10 units horizontal (10-percent slope).

**1809.4 Depth and width of footings.** The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809.5 shall also be satisfied. The minimum width of footings shall be 12 inches (305 mm).

**1809.5 Frost protection.** Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality;

2. Constructing in accordance with ASCE 32; or
3. Erecting on solid rock.

**Exception:** Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I, in accordance with Section 1604.5;
2. Area of 600 square feet (56 m<sup>2</sup>) or less for light-frame construction or 400 square feet (37 m<sup>2</sup>) or less for other than light-frame construction; and
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

**1809.6 Location of footings.** Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

**1809.7 Prescriptive footings for light-frame construction.** Where a specific design is not provided, concrete or masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

**TABLE 1809.7**  
**PRESCRIPTIVE FOOTINGS SUPPORTING WALLS OF**  
**LIGHT-FRAME CONSTRUCTION<sup>a, b, c, d, e</sup>**

NUMBER OF FLOORS SUPPORTED BY THE FOOTING <sup>f</sup>	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8 <sup>g</sup>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Depth of footings shall be in accordance with Section 1809.4.
- b. The ground under the floor shall be permitted to be excavated to the elevation of the top of the footing.
- c. Interior stud-bearing walls shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.
- d. See Section 1905 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.
- e. For thickness of foundation walls, see Section 1807.1.6.
- f. Footings shall be permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
- g. Plain concrete footings for Group R-3 occupancies shall be permitted to be 6 inches thick.

**1809.8 Plain concrete footings.** The edge thickness of plain concrete footings supporting walls of other than light-frame construction shall not be less than 8 inches (203 mm) where placed on soil or rock.

**Exception:** For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

**1809.9 Masonry-unit footings.** The design, materials and construction of masonry-unit footings shall comply with Sec-

tions 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

**Exception:** Where a specific design is not provided, masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

**1809.9.1 Dimensions.** Masonry-unit footings shall be laid in Type M or S mortar complying with Section 2103.9 and the depth shall not be less than twice the projection beyond the wall, pier or column. The width shall not be less than 8 inches (203 mm) wider than the wall supported thereon.

**1809.9.2 Offsets.** The maximum offset of each course in brick foundation walls stepped up from the footings shall be 1½ inches (38 mm) where laid in single courses, and 3 inches (76 mm) where laid in double courses.

**1809.10 Pier and curtain wall foundations.** Except in Seismic Design Categories D, E and F, pier and curtain wall foundations shall be permitted to be used to support light-frame construction not more than two stories above grade plane, provided the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings bonded integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall not be less than 4 inches (102 mm) nominal or 3⅝ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced 6 feet (1829 mm) on center (o.c.).
3. Piers shall be constructed in accordance with Chapter 21 and the following:
  - 3.1. The unsupported height of the masonry piers shall not exceed 10 times their least dimension.
  - 3.2. Where structural clay tile or hollow concrete masonry units are used for piers supporting beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar.
- 3.3. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete or the cavities of the top course shall be filled with concrete or grout.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood frame walls and floors shall not be more than 4 feet (1219 mm) in height.
5. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry, nor 12 inches (305 mm) for hollow masonry.

**Exception:** Unfilled hollow piers shall be permitted where the unsupported height of the pier is not more than four times its least dimension.

**1809.11 Steel grillage footings.** Grillage footings of structural steel shapes shall be separated with approved steel spac-



ers and be entirely encased in concrete with at least 6 inches (152 mm) on the bottom and at least 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

**1809.12 Timber footings.** Timber footings shall be permitted for buildings of Type V construction and as otherwise approved by the building official. Such footings shall be treated in accordance with AWP A U1 (Commodity Specification A, Use Category 4B). Treated timbers are not required where placed entirely below permanent water level, or where used as capping for wood piles that project above the water level over submerged or marsh lands. The compressive stresses perpendicular to grain in untreated timber footings supported upon treated piles shall not exceed 70 percent of the allowable stresses for the species and grade of timber as specified in the AF&PA NDS.

**1809.13 Footing seismic ties.** Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Section 1613.3.2 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient,  $S_{DS}$ , divided by 10 and 25 percent of the smaller footing design gravity load.

## SECTION 1810 DEEP FOUNDATIONS

**1810.1 General.** Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810.1 through 1810.4.

**1810.1.1 Geotechnical investigation.** Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803.

**1810.1.2 Use of existing deep foundation elements.** Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

**1810.1.3 Deep foundation elements classified as columns.** Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810.2.1.

**Exception:** Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to

design and construct such an element as a pedestal in accordance with ACI 318.

**1810.1.4 Special types of deep foundations.** The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

**1810.2 Analysis.** The analysis of deep foundations for design shall be in accordance with Sections 1810.2.1 through 1810.2.5.

**1810.2.1 Lateral support.** Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

**1810.2.2 Stability.** Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced at least 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

### Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is no less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810.2.1 is provided for the entire height and the height does not exceed 12 times the least horizontal dimension.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided the centers of the elements are located within the width of the supported wall.

**1810.2.3 Settlement.** The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

**1810.2.4 Lateral loads.** The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

**1810.2.4.1 Seismic Design Categories D through F.**

For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613.3.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

**Exception:** Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section 1810.3.8.3.3.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 21.6.4.2, 21.6.4.3 and 21.6.4.4 of ACI 318 as required by Section 1810.3.9.4.2.2.

**1810.2.5 Group effects.** The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element.

**1810.3 Design and detailing.** Deep foundations shall be designed and detailed in accordance with Sections 1810.3.1 through 1810.3.12.

**1810.3.1 Design conditions.** Design of deep foundations shall include the design conditions specified in Sections 1810.3.1.1 through 1810.3.1.6, as applicable.

**1810.3.1.1 Design methods for concrete elements.**

Where concrete deep foundations are laterally supported in accordance with Section 1810.2.1 for the entire height and applied forces cause bending moments no greater than those resulting from accidental eccentricities, structural design of the element using the load

combinations of Section 1605.3 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the load combinations of Section 1605.2 and approved strength design methods.

**1810.3.1.2 Composite elements.** Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

**1810.3.1.3 Mislocation.** The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by no less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

**1810.3.1.4 Driven piles.** Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

**1810.3.1.5 Helical piles.** Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

**1810.3.1.5.1 Helical piles seismic requirements.**

*[OSHPD 2] For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to design ultimate strength determined by using load combinations in Section 1605.2.1.*

*Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least  $1/16$ " corrosion allowance.*

*Helical piles shall not be considered as carrying any horizontal loads.*

**1810.3.1.6 Casings.** Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently water tight to exclude any foreign materials during the placing of concrete. Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810.3.6.

**1810.3.2 Materials.** The materials used in deep foundation elements shall satisfy the requirements of Sections 1810.3.2.1 through 1810.3.2.8, as applicable.

**1810.3.2.1 Concrete.** Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate

shall be  $\frac{3}{4}$  inch (19.1 mm). Concrete to be compacted shall have a zero slump.

**1810.3.2.1.1 Seismic hooks.** For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

**1810.3.2.1.2 ACI 318 Equation (10-5).** Where this chapter requires detailing of concrete deep foundation elements in accordance with Section 21.6.4.4 of ACI 318, compliance with Equation (10-5) of ACI 318 shall not be required.

**1810.3.2.2 Prestressing steel.** Prestressing steel shall conform to ASTM A 416.

**1810.3.2.3 Structural steel.** Structural steel piles, steel pipe and fully welded steel piles fabricated from plates shall conform to ASTM A 36, ASTM A 252, ASTM A 283, ASTM A 572, ASTM A 588, ASTM A 690, ASTM A 913 or ASTM A 992.

**1810.3.2.4 Timber.** Timber deep foundation elements shall be designed as piles or poles in accordance with AF&PA NDS. Round timber elements shall conform to ASTM D 25. Sawn timber elements shall conform to DOC PS-20.

**1810.3.2.4.1 Preservative treatment.** Timber deep foundation elements used to support permanent

structures shall be treated in accordance with this section unless it is established that the tops of the untreated timber elements will be below the lowest ground-water level assumed to exist during the life of the structure. Preservative and minimum final retention shall be in accordance with AWP A U1 (Commodity Specification E, Use Category 4C) for round timber elements and AWP A U1 (Commodity Specification A, Use Category 4B) for sawn timber elements. Preservative-treated timber elements shall be subject to a quality control program administered by an approved agency. Element cutoffs shall be treated in accordance with AWP A M4.

**1810.3.2.5 Protection of materials.** Where boring records or site conditions indicate possible deleterious action on the materials used in deep foundation elements because of soil constituents, changing water levels or other factors, the elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the elements so as not to be rendered ineffective by installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

**1810.3.2.6 Allowable stresses.** The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810.3.2.6.

**TABLE 1810.3.2.6  
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS**

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS <sup>a</sup>
1. Concrete or grout in compression <sup>b</sup> Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7 Cast-in-place in a pipe, tube, other permanent casing or rock Cast-in-place without a permanent casing Precast nonprestressed Precast prestressed	$0.4 f'_c$ $0.33 f'_c$ $0.3 f'_c$ $0.33 f'_c$ $0.33 f'_c - 0.27 f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4 f_y \leq 30,000$ psi
3. Structural steel in compression Cores within concrete-filled pipes or tubes Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Pipes or tubes for micropiles Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000$ psi $0.5 F_y \leq 32,000$ psi $0.4 F_y \leq 32,000$ psi $0.35 F_y \leq 16,000$ psi $0.6 F_y \leq 0.5 F_u$
4. Nonprestressed reinforcement in tension Within micropiles Other conditions	$0.6 f_y$ $0.5 f_y \leq 24,000$ psi
5. Structural steel in tension Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000$ psi $0.35 F_y \leq 16,000$ psi $0.6 F_y \leq 0.5 F_u$
6. Timber	In accordance with the AF&PA NDS

a.  $f'_c$  is the specified compressive strength of the concrete or grout;  $f_{pc}$  is the compressive stress on the gross concrete section due to effective prestress forces only;  $f_y$  is the specified yield strength of reinforcement;  $F_y$  is the specified minimum yield stress of structural steel;  $F_u$  is the specified minimum tensile stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area within the concrete surface. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the concrete surface.

**1810.3.2.7 Increased allowable compressive stress for cased cast-in-place elements.** The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.
3. The thickness of the casing shall not be less than manufacturer's standard gage No.14 (0.068 inch) (1.75 mm).
4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. The ratio of steel yield strength ( $F_y$ ) to specified compressive strength ( $f'_c$ ) shall not be less than six.
6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).

**1810.3.2.8 Justification of higher allowable stresses.**

Use of allowable stresses greater than those specified in Section 1810.3.2.6 shall be permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include:

1. A geotechnical investigation in accordance with Section 1803; and
2. Load tests in accordance with Section 1810.3.3.1.2, regardless of the load supported by the element.

The design and installation of the deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations who shall submit a report to the building official stating that the elements as installed satisfy the design criteria.

**1810.3.3 Determination of allowable loads.** The allowable axial and lateral loads on deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

**1810.3.3.1 Allowable axial load.** The allowable axial load on a deep foundation element shall be determined in accordance with Sections 1810.3.3.1.1 through 1810.3.3.1.9.

**1810.3.3.1.1 Driving criteria.** The allowable compressive load on any driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate driveability for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1810.3.3.1.2. The formula

or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven elements. The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

**1810.3.3.1.2 Load tests.** Where design compressive loads are greater than those determined using the allowable stresses specified in Section 1810.3.2.6, where the design load for any deep foundation element is in doubt, or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test elements shall be tested in accordance with ASTM D 1143 or ASTM D 4945. At least one element shall be load tested in each area of uniform subsoil conditions. Where required by the building official, additional elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test element as assessed by one of the published methods listed in Section 1810.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential settlements at design load in accordance with Section 1810.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (e.g., net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance.

**1810.3.3.1.3 Load test evaluation methods.** It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90% Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

**1810.3.3.1.4 Allowable frictional resistance.** The assumed frictional resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1806.2, up to a maximum of 500 psf (24 kPa), unless a greater value is allowed by the building official on

the basis of a geotechnical investigation as specified in Section 1803 or a greater value is substantiated by a load test in accordance with Section 1810.3.3.1.2. Frictional resistance and bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803.

**1810.3.3.1.5 Uplift capacity of a single deep foundation element.** Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D 3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810.3.3.1.2, using the results of load tests conducted in accordance with ASTM D 3689, divided by a factor of safety of two.

**Exception:** Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

**1810.3.3.1.6 Uplift capacity of grouped deep foundation elements.** For grouped deep foundation elements subjected to uplift, the allowable working uplift load for the group shall be calculated by an approved method of analysis where the deep foundation elements in the group are placed at a center-to-center spacing of at least 2.5 times the least horizontal dimension of the largest single element, the allowable working uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual uplift working load times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

**1810.3.3.1.7 Load-bearing capacity.** Deep foundation elements shall develop ultimate load capacities of at least twice the design working loads in the designated load-bearing layers. Analysis shall show that no soil layer underlying the designated load-bearing layers causes the load-bearing capacity safety factor to be less than two.

**1810.3.3.1.8 Bent deep foundation elements.** The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

**1810.3.3.1.9 Helical piles.** The allowable axial design load,  $P_a$ , of helical piles shall be determined as follows:

$$P_a = 0.5 P_u \quad \text{(Equation 18-4)}$$

where  $P_u$  is the least value of:

1. Sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests.
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

**1810.3.3.2 Allowable lateral load.** Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests to at least twice the proposed design working load. The resulting allowable load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

**1810.3.4 Subsiding soils.** Where deep foundation elements are installed through subsiding fills or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces that may be imposed on the elements by the subsiding upper strata.

Where the influence of subsiding fills is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

**1810.3.5 Dimensions of deep foundation elements.** The dimensions of deep foundation elements shall be in accordance with Sections 1810.3.5.1 through 1810.3.5.3, as applicable.

**1810.3.5.1 Precast.** The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

**1810.3.5.2 Cast-in-place or grouted-in-place.** Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

**1810.3.5.2.1 Cased.** Cast-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

**1810.3.5.2.2 Uncased.** Cast-in-place deep foundation elements without a permanent casing shall have a diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the average diameter.

**Exception:** The length of the element is permitted to exceed 30 times the diameter, provided the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

**1810.3.5.2.3 Micropiles.** Micropiles shall have an outside diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810.3.5 shall not apply to micropiles.

**1810.3.5.3 Steel.** Steel deep foundation elements shall satisfy the requirements of this section.

**1810.3.5.3.1 H-piles.** Sections of H-piles shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall not be less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall not be less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of  $\frac{3}{8}$  inch (9.5 mm).

**1810.3.5.3.2 Steel pipes and tubes.** Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have a minimum of 0.34 square inch (219 mm<sup>2</sup>) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to *Seismic Design Category C, D, E or F* shall have a wall thickness of not less than  $\frac{3}{16}$  inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18

inches (457 mm), a wall thickness of not less than  $\frac{3}{8}$  inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

**Exceptions:**

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be  $\frac{1}{10}$  inch (2.5 mm).

**1810.3.5.3.3 Helical piles.** Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

**1810.3.6 Splices.** Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

**1810.3.6.1 Seismic Design Categories C through F.**

For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element; and
2. The axial and shear forces and moments from the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

**1810.3.7 Top of element detailing at cutoffs.** Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

**1810.3.8 Precast concrete piles.** Precast concrete piles shall be designed and detailed in accordance with Sections 1810.3.8.1 through 1810.3.8.3.

**1810.3.8.1 Reinforcement.** Longitudinal steel shall be arranged in a symmetrical pattern and be laterally tied with steel ties or wire spiral spaced center to center as follows:

1. At not more than 1 inch (25 mm) for the first five ties or spirals at each end; then
2. At not more than 4 inches (102 mm), for the remainder of the first 2 feet (610 mm) from each end; and then
3. At not more than 6 inches (152 mm) elsewhere.

The size of ties and spirals shall be as follows:

1. For piles having a least horizontal dimension of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).
2. For piles having a least horizontal dimension of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage).
3. For piles having a least horizontal dimension of 20 inches (508 mm) and larger, wire shall not be smaller than  $\frac{1}{4}$  inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

**1810.3.8.2 Precast nonprestressed piles.** Precast nonprestressed concrete piles shall comply with the requirements of Sections 1810.3.8.2.1 through 1810.3.8.2.3.

**1810.3.8.2.1 Minimum reinforcement.** Longitudinal reinforcement shall consist of at least four bars with a minimum longitudinal reinforcement ratio of 0.008.

**1810.3.8.2.2 Seismic reinforcement in Seismic Design Categories C through F.** For structures assigned to Seismic Design Category C, D, E or F, precast nonprestressed piles shall be reinforced as specified in this section. The minimum longitudinal reinforcement ratio shall be 0.01 throughout the length. Transverse reinforcement shall consist of closed ties or spirals with a minimum  $\frac{3}{8}$  inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of eight times the diameter of the smallest longitudinal bar or 6 inches (152 mm) within a distance of three times the least pile dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm) throughout the remainder of the pile.

**1810.3.8.2.3 Additional seismic reinforcement in Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, transverse reinforcement shall be in accordance with Section 1810.3.9.4.2.

**1810.3.8.3 Precast prestressed piles.** Precast prestressed concrete piles shall comply with the requirements of Sections 1810.3.8.3.1 through 1810.3.8.3.3.

**1810.3.8.3.1 Effective prestress.** The effective prestress in the pile shall not be less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

**1810.3.8.3.2 Seismic reinforcement in Seismic Design Category C.** For structures assigned to Seismic Design Category C, precast prestressed piles shall have transverse reinforcement in accordance with this section. The volumetric ratio of spiral reinforcement shall not be less than the amount required by the following formula for the upper 20 feet (6096 mm) of the pile.

$$\rho_s = 0.12f'_c / f_{yh} \quad \text{(Equation 18-5)}$$

where:

$f'_c$  = Specified compressive strength of concrete, psi (MPa).

$f_{yh}$  = Yield strength of spiral reinforcement  $\leq$  85,000 psi (586 MPa).

$\rho_s$  = Spiral reinforcement index (vol. spiral/vol. core).

At least one-half the volumetric ratio required by Equation 18-5 shall be provided below the upper 20 feet (6096 mm) of the pile.

**1810.3.8.3.3 Seismic reinforcement in Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, precast prestressed piles shall have transverse reinforcement in accordance with the following:

1. Requirements in ACI 318, Chapter 21, need not apply, unless specifically referenced.
2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand or 8 inches (203 mm), whichever is smallest.

4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of each spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Section 12.14.3 of ACI 318.
5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region shall comply with the following:

$$\rho_s = 0.25(f'_c/f_{yh})(A_g/A_{ch} - 1.0) / [0.5 + 1.4P/(f'_c A_g)] \quad \text{(Equation 18-6)}$$

but not less than

$$\rho_s = 0.12(f'_c/f_{yh}) / [0.5 + 1.4P/(f'_c A_g)] \geq 0.12f'_c/f_{yh} \quad \text{(Equation 18-7)}$$

and need not exceed:

$$\rho_s = 0.021 \quad \text{(Equation 18-8)}$$

where:

$A_g$  = Pile cross-sectional area, square inches (mm<sup>2</sup>).

$A_{ch}$  = Core area defined by spiral outside diameter, square inches (mm<sup>2</sup>).

$f'_c$  = Specified compressive strength of concrete, psi (MPa).

$f_{yh}$  = Yield strength of spiral reinforcement  $\leq$  85,000 psi (586 MPa).

$P$  = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

$\rho_s$  = Volumetric ratio (vol. spiral/vol. core).

This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.

6. Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing,  $s$ , and perpendicular dimension,  $h_c$ , shall conform to:

$$A_{sh} = 0.3s h_c (f'_c/f_{yh})(A_g/A_{ch} - 1.0) / [0.5 + 1.4P/(f'_c A_g)] \quad \text{Equation 18-9}$$

but not less than:

$$A_{sh} = 0.12s h_c (f'_c/f_{yh}) [0.5 + 1.4P/(f'_c A_g)] \quad \text{(Equation 18-10)}$$

where:

$f_{yh}$  = yield strength of transverse reinforcement  $\leq$  70,000 psi (483 MPa).

$h_c$  = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).

$s$  = Spacing of transverse reinforcement measured along length of pile, inch (mm).

$A_{sh}$  = Cross-sectional area of transverse reinforcement, square inches (mm<sup>2</sup>).

$f'_c$  = Specified compressive strength of concrete, psi (MPa).

The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.

Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.

**1810.3.9 Cast-in-place deep foundations.** Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through 1810.3.9.6.

**1810.3.9.1 Design cracking moment.** The design cracking moment ( $\phi M_n$ ) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3\sqrt{f'_c} S_m \quad \text{(Equation 18-11)}$$

$$\text{For SI: } \phi M_n = 0.25\sqrt{f'_c} S_m$$

where:

$f'_c$  = Specified compressive strength of concrete or grout, psi (MPa).

$S_m$  = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm<sup>3</sup>).

**1810.3.9.2 Required reinforcement.** Where subject to uplift or where the required moment strength determined using the load combinations of Section 1605.2 exceeds the design cracking moment determined in accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

**1810.3.9.3 Placement of reinforcement.** Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

#### Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semi-fluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudi-



nal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.

3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided the construction method can be demonstrated to the satisfaction of the building official.

**1810.3.9.4 Seismic reinforcement.** Where a structure is assigned to Seismic Design Category C, reinforcement shall be provided in accordance with Section 1810.3.9.4.1. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810.3.9.4.2.

**Exceptions:**

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load,  $E$ , to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 12.4.3.2 or 12.14.3.2 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810.2.1.
4. Closed ties or spirals where required by Section 1810.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep

foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

**1810.3.9.4.1 Seismic reinforcement in Seismic Design Category C.** For structures assigned to Seismic Design Category C, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

A minimum of four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined below starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length;
2. A distance of 10 feet (3048 mm);
3. Three times the least element dimension; and
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals with a minimum  $\frac{3}{8}$  inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

**Exceptions:**

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard gage No.14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

**1810.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be rein-

forced as specified in this section. Reinforcement shall be provided where required by analysis.

A minimum of four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined below starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length;
2. A distance of 10 feet (3048 mm);
3. Three times the least element dimension; and
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals no smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters;
2. One-half the least dimension of the element; and
3. 12 inches (305 mm).

**Exceptions:**

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard gage No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

**1810.3.9.4.2.1 Site Classes A through D.** For *Site Class* A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 21.6.4.2, 21.6.4.3 and 21.6.4.4 of ACI 318 within three times the least element dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Section 21.6.4.4(a) of ACI 318 shall be permitted.

**1810.3.9.4.2.2 Site Classes E and F.** For *Site Class* E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 21.6.4.2, 21.6.4.3 and 21.6.4.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

**1810.3.9.5 Belled drilled shafts.** Where drilled shafts are belled at the bottom, the edge thickness of the bell shall not be less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

**1810.3.9.6 Socketed drilled shafts.** Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall not be less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

**1810.3.10 Micropiles.** Micropiles shall be designed and detailed in accordance with Sections 1810.3.10.1 through 1810.3.10.4.

**1810.3.10.1 Construction.** Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by at least their development length in tension in accordance with ACI 318.

**1810.3.10.2 Materials.** Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A 615 Grade 60 or 75 or ASTM A 722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of  $\frac{3}{16}$  inch (4.8 mm). Splices shall comply with Section 1810.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

**1810.3.10.3 Reinforcement.** For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry at least 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

**1810.3.10.4 Seismic reinforcement.** For structures assigned to Seismic Design Category C, a permanent steel casing shall be provided from the top of the micropile down to the point of zero curvature. For structures assigned to Seismic Design Category D, E or F, the micropile shall be considered as an alternative system in accordance with Section 104.11, *Chapter 1, Division II*. The alternative system design, supporting documentation and test data shall be submitted to the building official for review and approval.

*[HCD 1 & HCD 2] For structures assigned to Seismic Design Category D, E or F, the micropile shall be considered as an alternative system in accordance with Section 1.8.7, Chapter 1, Division 1. The alternative system design, supporting documentation and test data shall be submitted to the building official for review and approval.*

**1810.3.10.4.1 Seismic requirements. [OSHPD 2]** For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of  $\frac{3}{8}$  inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to design ultimate strength determined by using load combinations in Section 1605.2.1.

Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 21.12.4.

Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least  $\frac{1}{16}$ -inch corrosion allowance.

Micropiles shall not be considered as carrying any horizontal loads.

**1810.3.11 Pile caps.** Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep

foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load. The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend at least 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

**1810.3.11.1 Seismic Design Categories C through F.**

For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap by embedding the element reinforcement or field-placed dowels anchored in the element into the pile cap for a distance equal to their development length in accordance with ACI 318. It shall be permitted to connect precast prestressed piles to the pile cap by developing the element prestressing strands into the pile cap provided the connection is ductile. For deformed bars, the development length is the full development length for compression, or tension in the case of uplift, without reduction for excess reinforcement in accordance with Section 12.2.5 of ACI 318. Alternative measures for laterally confining concrete and maintaining toughness and ductile-like behavior at the top of the element shall be permitted provided the design is such that any hinging occurs in the confined region.

The minimum transverse steel ratio for confinement shall not be less than one-half of that required for columns.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

**1810.3.11.2 Seismic Design Categories D through F.**

For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop a minimum of 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
  - 1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element;
  - 1.2. The nominal tensile strength of a steel element; and

- 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

**Exception:** The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7; or shall be capable of developing the full axial, bending and shear nominal strength of the element.

Where the vertical lateral force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

**1810.3.12 Grade beams.** For structures assigned to Seismic Design Category D, E or F, grade beams shall comply with the provisions in Section 21.12.3 of ACI 318 for grade beams, except where they are designed to resist the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

**1810.3.13 Seismic ties.** For structures assigned to Seismic Design Category C, D, E or F, individual deep foundations shall be interconnected by ties. Unless it can be demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade or confinement by competent rock, hard cohesive soils or very dense granular soils, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger pile cap or column design gravity load times the seismic coefficient,  $S_{DS}$ , divided by 10, and 25 percent of the smaller pile or column design gravity load.

**Exception:** In Group R-3 and U occupancies of light-frame construction, deep foundation elements supporting foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

**1810.4 Installation.** Deep foundations shall be installed in accordance with Section 1810.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

**1810.4.1 Structural integrity.** Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that may adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

**1810.4.1.1 Compressive strength of precast concrete piles.** A precast concrete pile shall not be driven before the concrete has attained a compressive strength of at least 75 percent of the specified compressive strength ( $f'_c$ ), but not less than the strength sufficient to withstand handling and driving forces.

**1810.4.1.2 Casing.** Where cast-in-place deep foundation elements are formed through unstable soils and concrete is placed in an open-drilled hole, a casing shall be inserted in the hole prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

**1810.4.1.3 Driving near uncased concrete.** Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If the concrete surface in any completed element rises or drops, the element shall be replaced. Driven uncased deep foundation elements shall not be installed in soils that could cause heave.

**1810.4.1.4 Driving near cased concrete.** Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

**1810.4.1.5 Defective timber piles.** Any substantial sudden increase in rate of penetration of a timber pile shall be investigated for possible damage. If the sudden increase in rate of penetration cannot be correlated to soil strata, the pile shall be removed for inspection or rejected.

**1810.4.2 Identification.** Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

**1810.4.3 Location plan.** A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

**1810.4.4 Preexcavation.** The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be driven below the preexcavated depth until the required resistance or penetration is obtained.

**1810.4.5 Vibratory driving.** Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

**1810.4.6 Heaved elements.** Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810.3.3.1.2.

**1810.4.7 Enlarged base cast-in-place elements.** Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

**1810.4.8 Hollow-stem augered, cast-in-place elements.** Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than

12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

**1810.4.9 Socketed drilled shafts.** The rock socket and pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

**1810.4.10 Micropiles.** Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to assure grout coverage outside the casing.

**1810.4.11 Helical piles.** Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the maximum allowable installation torque of the helical pile.

**1810.4.12 Special inspection.** Special inspections in accordance with Sections 1705.7 and 1705.8 shall be provided for driven and cast-in-place deep foundation elements, respectively. Special inspections in accordance with Section 1705.9 shall be provided for helical piles.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 18A – SOILS AND FOUNDATIONS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>							X	X	X			X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## CHAPTER 18A

# SOILS AND FOUNDATIONS

### SECTION 1801A GENERAL

**1801A.1 Scope.** The provisions of this chapter shall apply to building and foundation systems.

*Refer to Appendix J, Grading, for requirements governing grading, excavation and earthwork construction, including fills and embankments.*

**1801A.1.1 Application.** *The scope of application of Chapter 18A is as follows:*

- 1. Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS), and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings*
- 2. Applications listed in Section 1.10.1 and 1.10.4 regulated by the Office of Statewide Health Planning and Development (OSHDP). These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.*

**Exception:** *[OSHDP 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 18 and any applicable amendments therein.*

**1801A.1.2 Amendments in this chapter.** *DSA-SS and DSA-SS/CC adopt this chapter and all amendments.*

**Exception:** *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

- 1. Division of the State Architect-Structural Safety:*  
**[DSA-SS]** *For applications listed in Section 1.9.2.1.*  
**[DSA-SS/CC]** *For applications listed in Section 1.9.2.2.*
- 2. Office of Statewide Health Planning and Development:*  
**[OSHDP 1]** *- For applications listed in Section 1.10.1.*  
**[OSHDP 4]** *- For applications listed in Section 1.10.4.*

**1801A.1.3 Reference to other chapters.**

**1801A.1.3.1 [DSA-SS/CC]** *Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A, 22A, and 34A, the provisions in Chapters*

*16, 19, 21, 22, and 34 respectively shall apply instead.*

**1801A.2 Design basis.** Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in Section 1605A.3. The quality and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16A, 19A, 21A, 22A, and 23 of this code. Excavations and fills shall also comply with Chapter 33.

### SECTION 1802A DEFINITIONS

**1802A.1 Definitions.** The following words and terms are defined in Chapter 2;

**DEEP FOUNDATION.**

**DRILLED SHAFT.**

**Socketed drilled shaft.**

**HELICAL PILE.**

**MICROPILE.**

**SHALLOW FOUNDATION.**

### SECTION 1803A GEOTECHNICAL INVESTIGATIONS

**1803A.1 General.** Geotechnical investigations shall be conducted in accordance with Section 1803A.2 and reported in accordance with Section 1803A.7. *The classification and investigation of the soil shall be made under the responsible charge of a California registered geotechnical engineer. All recommendations contained in geotechnical and geohazard reports shall be subject to the approval of the enforcement agency. All reports shall be prepared and signed by a registered geotechnical engineer, a certified engineering geologist, and a registered geophysicist, where applicable*

**1803A.2 Investigations required.** Geotechnical investigations shall be conducted in accordance with Sections 1803A.3 through 1803A.6.

**Exceptions:**

- 1. Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m<sup>2</sup>) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan. Allowable foundation and lateral soil pressure values may be determined from Table 1806A.2.*



2. A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.

**1803A.3 Basis of investigation.** Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

**1803A.3.1 Scope of investigation.** The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

*There shall not be less than one boring or exploration shaft for each 5,000 square feet (465 m<sup>2</sup>) of building area at the foundation level with a minimum of two provided for any one building. A boring may be considered to reflect subsurface conditions relevant to more than one building, subject to the approval of the enforcement agency.*

*Borings shall be of sufficient size to permit visual examination of the soil in place or, in lieu thereof, cores shall be taken.*

*Borings shall be of sufficient depth and size to adequately characterize sub-surface conditions.*

**1803A.4 Qualified representative.** The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

**1803A.5 Investigated conditions.** Geotechnical investigations shall be conducted as indicated in Sections 1803A.5.1 through 1803A.5.12.

**1803A.5.1 Classification.** Soil materials shall be classified in accordance with ASTM D 2487.

**1803A.5.2 Questionable soil.** Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

**1803A.5.3 Expansive soil.** In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D 4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75 µm), determined in accordance with ASTM D 422.

3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.

4. Expansion index greater than 20, determined in accordance with ASTM D 4829.

**1803A.5.4 Ground-water table.** A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

**1803A.5.5 Deep foundations.** Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data upon which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.
2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

**1803A.5.6 Rock strata.** Where subsurface explorations at the project site indicate variations or doubtful characteristics in the structure of the rock upon which foundations are to be constructed, a sufficient number of borings shall be made to a depth of not less than 10 feet (3048 mm) below the level of the foundations to provide assurance of the soundness of the foundation bed and its load-bearing capacity.

**1803A.5.7 Excavation near foundations.** Where excavation will remove lateral support from any foundation, an investigation shall be conducted to assess the potential consequences and address mitigation measures.

**1803A.5.8 Compacted fill material.** Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.

4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

**1803A.5.9 Controlled low-strength material (CLSM).**

Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

**1803A.5.10 Alternate setback and clearance.** Where setbacks or clearances other than those required in Section 1808A.7 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1808A.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

**1803A.5.11 Seismic Design Categories C through F.** For structures assigned to Seismic Design Category C, D, E or F, the geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

**1803A.5.12 Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, the geotechnical investigation required by Section 1803.5.11 shall also include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude, and source characteristics consis-

tent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on:

- 2.1 A site-specific study in accordance with Section 21.5 of ASCE 7; or
  - 2.2 In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss, including, but not limited to:
    - 3.1. Estimation of total and differential settlement;
    - 3.2. Lateral soil movement;
    - 3.3. Lateral soil loads on foundations;
    - 3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction;
    - 3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations;
    - 3.6. Increases in soil lateral pressures on retaining walls; and
    - 3.7. Flotation of buried structures.
  4. Discussion of mitigation measures such as, but not limited to:
    - 4.1. Selection of appropriate foundation type and depths;
    - 4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces;
    - 4.3. Ground stabilization; or
    - 4.4. Any combination of these measures and how they shall be considered in the design of the structure.

**1803A.6 Geohazard reports.** *Geohazard reports shall be required for all proposed construction.*

**Exceptions:**

1. *Reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m<sup>2</sup>) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan; nonstructural, associated structural or voluntary structural alterations, and incidental structural additions or alterations, and structural repairs for other than earthquake damage.*
2. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

*The purpose of the geohazard report shall be to identify geologic and seismic conditions that may require project mitigations. The reports shall contain data which provide an*

assessment of the nature of the site and potential for earthquake damage based on appropriate investigations of the regional and site geology, project foundation conditions and the potential seismic shaking at the site. The report shall be prepared by a California-certified engineering geologist in consultation with a California-registered geotechnical engineer.

The preparation of the geohazard report shall consider the most recent CGS Note 48: Checklist for the Review of Engineering Geology and Seismology Reports for California Public School, Hospitals, and Essential Services Buildings. In addition, the most recent version of CGS Special Publication 42, Fault Rupture Hazard Zones in California, shall be considered for project sites proposed within an Alquist-Priolo Earthquake Fault Zone. The most recent version of CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, shall be considered for project sites proposed within a Seismic Hazard Zone. All conclusions shall be fully supported by satisfactory data and analysis.

In addition to requirements in Sections 1803A.5.11 and 1803A.5.12, the report shall include, but shall not be limited to, the following:

1. Site geology.
2. Evaluation of the known active and potentially active faults, both regional and local.
3. Ground-motion parameters, as required by Sections 1613A and 1615A, and ASCE 7.

The three Next Generation Attenuation (NGA) relations used for the 2008 USGS seismic hazards maps for Western United States (WUS) shall be utilized to determine the site-specific ground motion. When supported by data and analysis, other NGA relations, that were not used for the 2008 USGS maps, shall be permitted as additions or substitutions. No fewer than three NGA relations shall be utilized.

**1803A.7 Geotechnical reporting.** Where geotechnical investigations are required, a written report of the investigations shall be submitted to the building official by the owner or authorized agent at the time of permit application. The geotechnical report shall provide completed evaluations of the foundation conditions of the site and the potential geologic/seismic hazards affecting the site. The geotechnical report shall include, but shall not be limited to, site-specific evaluations of design criteria related to the nature and extent of foundation materials, groundwater conditions, liquefaction potential, settlement potential and slope stability. The report shall contain the results of the analyses of problem areas identified in the geohazard report. The geotechnical report shall incorporate estimates of the characteristics of site ground motion provided in the geohazard report. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.

4. Elevation of the water table, if encountered. *Historic high ground water elevations shall be addressed in the report to adequately evaluate liquefaction and settlement potential.*
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.
6. Expected total and differential settlement.
7. Deep foundation information in accordance with Section 1803A.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803A.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803A.5.9.
11. *The report shall consider the effects of stepped footings addressed in Section 1809A.3.*
12. *The report shall consider the effects of seismic hazards in accordance with Section 1803A.6 and shall incorporate the associated geohazard report.*

**1803A.8 Geotechnical peer review.** [DSA-SS and DSA-SS/CC] When alternate foundations designs or ground improvements are employed or where slope stabilization is required, a qualified peer review by a California-licensed geotechnical engineer, in accordance with Section 3422, may be required by the enforcement agency. In Section 3422, where reference is made to structural or seismic-resisting system, it shall be replaced with geotechnical, foundation, or ground improvement, as appropriate.

## SECTION 1804A EXCAVATION, GRADING AND FILL

**1804A.1 Excavation near foundations.** Excavation for any purpose shall not remove lateral support from any foundation without first underpinning or protecting the foundation against settlement or lateral translation.

**1804A.2 Placement of backfill.** The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

**Exception:** CLSM need not be compacted.

**1804A.3 Site grading.** The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of

horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped a minimum of 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

**Exception:** Where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than one unit vertical in 48 units horizontal (2-percent slope).

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

**1804A.4 Grading and fill in flood hazard areas.** In flood hazard areas established in Section 1612A.3, grading and/or fill shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of flood water and, as applicable, wave action.
2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In flood hazard areas subject to high-velocity wave action, unless such fill is conducted and/or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed flood hazard area encroachment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point.

**1804A.5 Compacted fill material.** Where shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803A.

**Exception:** Compacted fill material 12 inches (305 mm) in depth or less need not comply with an approved report, provided the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557. The compaction shall be verified by special inspection in accordance with Section 1704A.7.

**1804A.6 Controlled low-strength material (CLSM).** Where shallow foundations will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803A.

## SECTION 1805A DAMPPOOFING AND WATERPROOFING

**1805A.1 General.** Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1203.4.

**1805A.1.1 Story above grade plane.** Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1805A.2 and a foundation drain shall be installed in accordance with Section 1805A.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803A.5.4, 1805A.3 and 1805A.4.1 shall not apply in this case.

**1805A.1.2 Under-floor space.** The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803A.5.4, 1805A.2, 1805A.3 and 1805A.4 shall not apply in this case.

**1805A.1.2.1 Flood hazard areas.** For buildings and structures in flood hazard areas as established in Section 1612A.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on at least one side.

**Exception:** Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA/FIA-TB-11.

**1805A.1.3 Ground-water control.** Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1805A.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

**1805A.2 Dampproofing.** Where hydrostatic pressure will not occur, as determined by Section 1803A.5.4, floors and walls shall be dampproofed in accordance with this section.

**1805A.2.1 Floors.** Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805A.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805A.2.2 Walls.** Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m<sup>2</sup>) of acrylic modified cement,  $\frac{1}{8}$  inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887, any of the materials permitted for waterproofing by Section 1805A.3.2 or other approved methods or materials.

**1805A.2.2.1 Surface preparation of walls.** Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than  $\frac{3}{8}$  inch (9.5 mm) of portland cement mortar. The parging shall be coved at the footing.

**Exception:** Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

**1805A.3 Waterproofing.** Where the ground-water investigation required by Section 1803A.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805A.1.3, walls and floors shall be waterproofed in accordance with this section.

**1805A.3.1 Floors.** Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805A.3.2 Walls.** Walls required to be waterproofed shall be of concrete or masonry and shall be designed and con-

structed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805A.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

**1805A.3.2.1 Surface preparation of walls.** Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805A.2.2.1.

**1805A.3.3 Joints and penetrations.** Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made water-tight utilizing approved methods and materials.

**1805A.4 Subsoil drainage system.** Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805A.1.3 shall be deemed adequate for lowering the ground-water table.

**1805A.4.1 Floor base course.** Floors of basements, except as provided for in Section 1805A.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

**Exception:** Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

**1805A.4.2 Foundation drain.** A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend a minimum of 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805A.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

**1805A.4.3 Drainage discharge.** The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *California Plumbing Code*.

**Exception:** Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

## SECTION 1806A

### PRESUMPTIVE LOAD-BEARING VALUES OF SOILS

**1806A.1 Load combinations.** The presumptive load-bearing values provided in Table 1806A.2 shall be used with the allowable stress design load combinations specified in Section 1605A.3. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806A.2 shall be permitted to be increased by one-third where used with the alternative basic load combinations of Section 1605A.3.2 that include wind or earthquake loads.

**1806A.2 Presumptive load-bearing values.** The load-bearing values used in design for supporting soils near the surface shall not exceed the values specified in Table 1806A.2 unless data to substantiate the use of higher values are submitted and approved. Where the building official has reason to doubt the classification, strength or compressibility of the soil, the requirements of Section 1803A.5.2 shall be satisfied.

Presumptive load-bearing values shall apply to materials with similar physical characteristics and dispositions. Mud, organic silt, organic clays, peat or unprepared fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

**Exception:** A presumptive load-bearing capacity shall be permitted to be used where the building official deems the load-bearing capacity of mud, organic silt or unprepared fill is adequate for the support of lightweight or temporary structures.

**1806A.3 Lateral load resistance.** Where the presumptive values of Table 1806A.2 are used to determine resistance to lateral loads, the calculations shall be in accordance with Sections 1806A.3.1 through 1806A.3.4.

**1806A.3.1 Combined resistance.** The total resistance to lateral loads shall be permitted to be determined by combining the values derived from the lateral bearing pressure and the lateral sliding resistance specified in Table 1806A.2.

**1806A.3.2 Lateral sliding resistance limit.** For clay, sandy clay, silty clay, clayey silt, silt and sandy silt, in no case shall the lateral sliding resistance exceed one-half the dead load.

**1806A.3.3 Increase for depth.** The lateral bearing pressures specified in Table 1806A.2 shall be permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a maximum of 15 times the tabular value.

**1806A.3.4 Increase for poles.** Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a  $\frac{1}{2}$  inch (12.7 mm) motion at the ground surface due to short-term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values.

## SECTION 1807A

### FOUNDATION WALLS, RETAINING WALLS AND EMBEDDED POSTS AND POLES

**1807A.1 Foundation walls.** Foundation walls shall be designed and constructed in accordance with Sections 1807A.1.1 through 1807A.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808A.

**1807A.1.1 Design lateral soil loads.** Foundation walls shall be designed for the lateral soil loads *determined by a geotechnical investigation, in accordance with Section 1803A*.

**1807A.1.2 Unbalanced backfill height.** Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill

TABLE 1806A.2  
PRESUMPTIVE LOAD-BEARING VALUES

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction <sup>a</sup>	Cohesion (psf) <sup>b</sup>
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and/or gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806A.3.2.

height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

**1807A.1.3 Rubble stone foundation walls.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1807A.1.4 Permanent wood foundation systems.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1807A.1.5 Concrete and masonry foundation walls.** Concrete and masonry foundation walls shall be designed in accordance with Chapter 19A or 21A, as applicable.

**1807A.2 Retaining walls.** Retaining walls shall be designed in accordance with Sections 1807A.2.1 through 1807A.2.3. *Freestanding cantilever walls shall be designed in accordance with Section 1807A.2.4.*

**1807A.2.1 General.** Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, lateral soil pressures on both sides of the keyway shall be considered in the sliding analysis.

**1807A.2.2 Design lateral soil loads.** Retaining walls shall be designed for the lateral soil loads *determined by a geotechnical investigation in accordance with Section 1803A and shall not be less than eighty percent of the lateral soil loads determined in accordance with Section 1610A.*

**1807A.2.3 Safety factor.** Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605A shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 1.0 times other nominal loads, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

**Exception:** Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

**1807A.2.4 Freestanding cantilever walls.** *A stability check against the possibility of overturning shall be performed for isolated spread footings which support freestanding cantilever walls. The stability check shall be made by dividing  $R_p$  used for the wall by 2.0. The allowable soil pressure may be doubled for this evaluation.*

**Exception:** *For overturning about the principal axis of rectangular footings with symmetrical vertical loading and the design lateral force applied, a triangular or trapezoidal soil pressure distribution which covers the full width of the footing will meet the stability requirement.*

**1807A.3 Embedded posts and poles.** Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807A.3.1 through 1807A.3.3.

**1807A.3.1 Limitations.** The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWP A U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

**1807A.3.2 Design criteria.** The depth to resist lateral loads shall be determined using the design criteria established in Sections 1807A.3.2.1 through 1807A.3.2.3, or by other methods approved by the building official.

**1807A.3.2.1 Nonconstrained.** The following formula shall be used in determining the depth of embedment required to resist lateral loads where no lateral constraint is provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where no lateral constraint is provided above the ground surface, such as by a structural diaphragm.

$$d = 0.5A \{ 1 + [1 + (4.36h/A)]^{1/2} \} \quad \text{(Equation 18A-1)}$$

where:

$$A = 2.34P/(S_1 b)$$

$b$  = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

$d$  = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

$h$  = Distance in feet (m) from ground surface to point of application of "P."

$P$  = Applied lateral force in pounds (kN).

$S_1$  = Allowable lateral soil-bearing pressure as set forth in Section 1806A.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

**1807A.3.2.2 Constrained.** The following formula shall be used to determine the depth of embedment required to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or pavement.

$$d = \sqrt{\frac{4.25Ph}{S_3 b}} \quad \text{(Equation 18A-2)}$$

or alternatively

$$d = \sqrt{\frac{4.25M_g}{S_3 b}} \quad \text{(Equation 18A-3)}$$

where:

$M_g$  = Moment in the post at grade, in foot-pounds (kN-m).

$S_3$  = Allowable lateral soil-bearing pressure as set forth in Section 1806A.2 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

**1807A.3.2.3 Vertical load.** The resistance to vertical loads shall be determined using the vertical foundation pressure set forth in Table 1806A.2.

**1807A.3.3 Backfill.** The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with a specified compressive strength of not less than 2,000 psi (13.8 MPa). The hole shall not be less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

## SECTION 1808A FOUNDATIONS

**1808A.1 General.** Foundations shall be designed and constructed in accordance with Sections 1808A.2 through 1808A.9. Shallow foundations shall also satisfy the requirements of Section 1809A. Deep foundations shall also satisfy the requirements of Section 1810A.

**1808A.2 Design for capacity and settlement.** Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808A.6.

*The enforcing agency may require an analysis of foundation elements to determine subgrade deformations in order to evaluate their effect on the superstructure, including story drift.*

**1808A.3 Design loads.** Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 1605A.2 or 1605A.3. The dead load is permitted to include the weight of foundations and overlying fill. Reduced live loads, as specified in Sections 1607A.9 and 1607A.11, shall be permitted to be used in the design of foundations.

**1808A.3.1 Seismic overturning.** Where foundations are proportioned using the load combinations of Section 1605.2 or 1605A.3.1, and the computation of seismic overturning effects is by equivalent lateral force analysis or modal analysis, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

**1808A.4 Vibratory loads.** Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

**1808A.5 Shifting or moving soils.** Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

**1808A.6 Design for expansive soils.** Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808A.6.1 or 1808A.6.2.

**Exception:** Foundation design need not comply with Section 1808A.6.1 or 1808A.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808A.6.3; or
2. The building official approves stabilization of the soil in accordance with Section 1808A.6.4.

**1808A.6.1 Foundations.** Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

**1808A.6.2 Slab-on-ground foundations.** Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* or *PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils*. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *PTI Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils*. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.



**1808A.6.3 Removal of expansive soil.** Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808A.6.1 or 1808A.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804A.5 or 1804A.6.

**Exception:** Expansive soil need not be removed to the depth of constant moisture, provided the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

**1808A.6.4 Stabilization.** Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808A.6.1 or 1808A.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

**1808A.7 Foundations on or adjacent to slopes.** The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808A.7.1 through 1808A.7.5.

**1808A.7.1 Building clearance from ascending slopes.** In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808A.7.5 and Figure 1808A.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

**1808A.7.2 Foundation setback from descending slope surface.** Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental

settlement. Except as provided for in Section 1808A.7.5 and Figure 1808A.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

**1808A.7.3 Pools.** The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

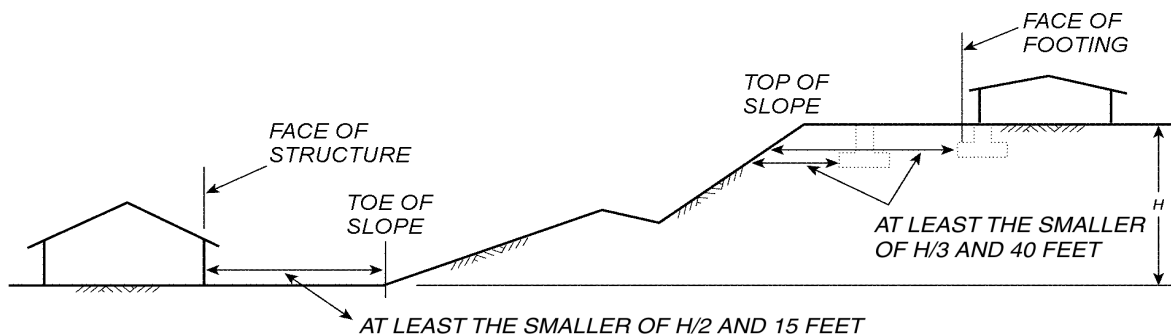
**1808A.7.4 Foundation elevation.** On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device a minimum of 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

**1808A.7.5 Alternate setback and clearance.** Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official shall be permitted to require a geotechnical investigation as set forth in Section 1803A.5.10.

**1808A.8 Concrete foundations.** The design, materials and construction of concrete foundations shall comply with Sections 1808A.8.1 through 1808A.8.6 and the provisions of Chapter 19A.

**1808A.8.1 Concrete or grout strength and mix proportioning.** Concrete or grout in foundations shall have a specified compressive strength ( $f'_c$ ) not less than the largest applicable value indicated in Table 1808A.8.1.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where



For SI: 1 foot = 304.8 mm.

**FIGURE 1808A.7.1**  
**FOUNDATION CLEARANCES FROM SLOPES**

concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

**1808A.8.2 Concrete cover.** The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be no less than the largest applicable value specified in Table 1808A.8.2. Longitudinal bars spaced less than  $1\frac{1}{2}$  inches (38 mm) clear distance apart shall be considered bundled bars for which the concrete cover provided shall also be no less than that required by Section 7.7.4 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered the concrete surface.

**1808A.8.3 Placement of concrete.** Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted

directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

**1808A.8.4 Protection of concrete.** Concrete foundations shall be protected from freezing during depositing and for a period of not less than five days thereafter. Water shall not be allowed to flow through the deposited concrete.

**1808A.8.5 Forming of concrete.** Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Chapter 6 of ACI 318.

**1808A.8.6 Seismic requirements.** See Section 1908A for additional requirements for foundations of structures assigned to Seismic Design Category D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of ACI 318, Sections 21.12.1 through 21.12.4, shall apply where not in conflict with the provisions of Sections 1808A through 1810A.

**1808A.9 Vertical masonry foundation elements.** Vertical masonry foundation elements that are not foundation piers as defined in Section 2102.1 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402/ACI 530/ASCE 5.

**TABLE 1808A.8.1  
MINIMUM SPECIFIED COMPRESSIVE STRENGTH  $f'_c$  OF CONCRETE OR GROUT**

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, $f'_c$
1. Foundations for structures assigned to Seismic Design Category D, E or F	3,000 psi
2. Precast nonprestressed driven piles	4,000 psi
3. Socketed drilled shafts	4,000 psi
4. Micropiles	4,000 psi
5. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

**TABLE 1808A.8.2  
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 7.7 of ACI 318
2. Precast nonprestressed deep foundation elements	
Exposed to seawater	3 inches
Not manufactured under plant conditions	2 inches
Manufactured under plant control conditions	In accordance with Section 7.7.3 of ACI 318
3. Precast prestressed deep foundation elements	
Exposed to seawater	2.5 inches
Other	In accordance with Section 7.7.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

## SECTION 1809A SHALLOW FOUNDATIONS

**1809A.1 General.** Shallow foundations shall be designed and constructed in accordance with Sections 1809A.2 through 1809A.13.

**1809A.2 Supporting soils.** Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804A.5. CLSM shall be placed in accordance with Section 1804A.6.

**1809A.3 Stepped footings.** The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than one unit vertical in 10 units horizontal (10-percent slope).

*Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50 percent slope) unless otherwise recommended by a geotechnical report. The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.*

**1809A.4 Depth and width of footings.** The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809A.5 shall also be satisfied. The minimum width of footings shall be 12 inches (305 mm).

**1809A.5 Frost protection.** Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality;
2. Constructing in accordance with ASCE 32; or
3. Erecting on solid rock.

**Exception:** Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I, in accordance with Section 1604A.5;
2. Area of 600 square feet (56 m<sup>2</sup>) or less for light-frame construction or 400 square feet (37 m<sup>2</sup>) or less for other than light-frame construction; and
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

**1809A.6 Location of footings.** Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

**1809A.7 Prescriptive footings for light-frame construction.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.* <

**1809A.8 Plain concrete footings.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.* <

**1809A.9 Masonry-unit footings.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.* <

**1809A.10 Reserved.** ||

**1809A.11 Steel grillage footings.** Grillage footings of structural steel shapes shall be separated with approved steel spacers and be entirely encased in concrete with at least 6 inches (152 mm) on the bottom and at least 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

**1809A.12 Timber footings.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.* <

**1809A.13 Footing seismic ties.** Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Section 1613A.5.2 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient,  $S_{DS}$ , divided by 10 and 25 percent of the smaller footing design gravity load.

**1809A.14 Pipes and trenches.** *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50 percent slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

*Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.*

**Exception:** Alternate trench locations and pipe clearances shall be permitted when approved by registered design professional in responsible charge and the enforcement agent.

**1809A.15 Grade beams:** [DSA-SS, DSA-SS/CC] *For structures assigned to Seismic Design Category D, E or F, grade beams in shallow foundations shall comply with Section 1810A.3.12.* ||

## SECTION 1810A DEEP FOUNDATIONS

**1810A.1 General.** Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810A.1 through 1810A.4.

**1810A.1.1 Geotechnical investigation.** Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803A.

**1810A.1.2 Use of existing deep foundation elements.**

Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

**1810A.1.3 Deep foundation elements classified as columns.** Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810A.2.1.

**Exception:** Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

**1810A.1.4 Special types of deep foundations.** The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

**1810A.2 Analysis.** The analysis of deep foundations for design shall be in accordance with Sections 1810A.2.1 through 1810A.2.5.

**1810A.2.1 Lateral support.** Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

**1810A.2.2 Stability.** Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced at least 1 foot (305 mm)

apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

**Exceptions:**

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is no less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810A.2.1 is provided for the entire height and the height does not exceed 12 times the least horizontal dimension.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided the centers of the elements are located within the width of the supported wall.

**1810A.2.3 Settlement.** The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

**1810A.2.4 Lateral loads.** The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

**1810A.2.4.1 Seismic Design Categories D through F.**

For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613A.5.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

**Exception:** Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section 1810A.3.8.3.3.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 21.6.4.2, 21.6.4.3 and 21.6.4.4 of ACI 318 as required by Section 1810A.3.9.4.2.2.

**1810A.2.5 Group effects.** The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element.

**1810A.3 Design and detailing.** Deep foundations shall be designed and detailed in accordance with Sections 1810A.3.1 through 1810A.3.12.

**1810A.3.1 Design conditions.** Design of deep foundations shall include the design conditions specified in Sections 1810A.3.1.1 through 1810A.3.1.6, as applicable.

**1810A.3.1.1 Design methods for concrete elements.**

Where concrete deep foundations are laterally supported in accordance with Section 1810A.2.1 for the entire height and applied forces cause bending moments no greater than those resulting from accidental eccentricities, structural design of the element using the load combinations of Section 1605A.3 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the load combinations of Section 1605A.2 and approved strength design methods.

**1810A.3.1.2 Composite elements.** Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

**1810A.3.1.3 Mislocation.** The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by no less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

**1810A.3.1.4 Driven piles.** Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

**1810A.3.1.5 Helical piles.** Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

**1810A.3.1.5.1 Helical piles seismic requirements.**

*For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810A.3.3 by at least two project specific preproduction tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to the load determined in accordance with Section 1615A.1.10.*

*Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least  $\frac{1}{16}$ " corrosion allowance.*

*Helical piles shall not be considered as carrying any horizontal loads.*

**1810A.3.1.6 Casings.** Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently water tight to exclude any foreign materials during the placing of concrete. Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810A.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810A.3.6.

**1810A.3.2 Materials.** The materials used in deep foundation elements shall satisfy the requirements of Sections 1810A.3.2.1 through 1810A.3.2.8, as applicable.

**1810A.3.2.1 Concrete.** Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate shall be  $\frac{3}{4}$  inch (19.1 mm). Concrete to be compacted shall have a zero slump.

**1810A.3.2.1.1 Seismic hooks.** For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

**1810A.3.2.2 Prestressing steel.** Prestressing steel shall conform to ASTM A 416.

**1810A.3.2.3 Structural steel.** Structural steel piles, steel pipe and fully welded steel piles fabricated from plates shall conform to ASTM A 36, ASTM A 252, ASTM A 283, ASTM A 572, ASTM A 588, ASTM A 690, ASTM A 913 or ASTM A 992.

**1810A.3.2.4 Timber.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1810A.3.2.5 Protection of materials.** Where boring records or site conditions indicate possible deleterious action on the materials used in deep foundation elements because of soil constituents, changing water levels or other factors, the elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the elements so as not to be rendered ineffective by installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

**1810A.3.2.6 Allowable stresses.** The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810A.3.2.6.

**1810A.3.2.7 Increased allowable compressive stress for cased cast-in-place elements.** The allowable compressive stress in the concrete shall be permitted to be

increased as specified in Table 1810A.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.
3. The thickness of the casing shall not be less than manufacturer's standard gage No. 14 (0.068 inch) (1.75 mm).
4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. The ratio of steel yield strength ( $F_y$ ) to specified compressive strength ( $f'_c$ ) shall not be less than six.
6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).

**1810A.3.2.8 Justification of higher allowable stresses.** Use of allowable stresses greater than those specified in Section 1810A.3.2.6 shall be permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include:

1. A geotechnical investigation in accordance with Section 1803A; and

2. Load tests in accordance with Section 1810A.3.3.1.2, regardless of the load supported by the element.

The design and installation of the deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations who shall submit a report to the building official stating that the elements as installed satisfy the design criteria.

**1810A.3.3 Determination of allowable loads.** The allowable axial and lateral loads on deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

**1810A.3.3.1 Allowable axial load.** The allowable axial load on a deep foundation element shall be determined in accordance with Sections 1810A.3.3.1.1 through 1810A.3.3.1.9.

**1810A.3.3.1.1 Driving criteria.** The allowable compressive load on any driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate driveability for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1810A.3.3.1.2. The formula or wave equation load shall be determined for grav-

**TABLE 1810A.3.2.6  
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS**

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS <sup>a</sup>
1. Concrete or grout in compression <sup>b</sup> Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7 Cast-in-place in a pipe, tube, other permanent casing or rock Cast-in-place without a permanent casing Precast nonprestressed Precast prestressed	$0.4 f'_c$ $0.33 f'_c$ $0.3 f'_c$ $0.33 f'_c$ $0.33 f'_c - 0.27 f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4 f_y \leq 30,000 \text{ psi}$
3. Structural steel in compression Cores within concrete-filled pipes or tubes Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Pipes or tubes for micropiles Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000 \text{ psi}$ $0.5 F_y \leq 32,000 \text{ psi}$ $0.4 F_y \leq 32,000 \text{ psi}$ $0.35 F_y \leq 16,000 \text{ psi}$ $0.6 F_y \leq 0.5 F_u$
4. Nonprestressed reinforcement in tension Within micropiles Other conditions	$0.6 f_y$ $0.5 f_y \leq 24,000 \text{ psi}$
5. Structural steel in tension Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000 \text{ psi}$ $0.35 F_y \leq 16,000 \text{ psi}$ $0.6 F_y \leq 0.5 F_u$
6. Timber	In accordance with the AF&PA NDS

a.  $f'_c$  is the specified compressive strength of the concrete or grout;  $f_{pc}$  is the compressive stress on the gross concrete section due to effective prestress forces only;  $f_y$  is the specified yield strength of reinforcement;  $F_y$  is the specified minimum yield stress of structural steel;  $F_u$  is the specified minimum tensile stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area within the concrete surface. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the concrete surface.

ity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven elements. The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

**1810A.3.3.1.2 Load tests.** Where design compressive loads are greater than those determined using the allowable stresses specified in Section 1810A.3.2.6, where the design load for any deep foundation element is in doubt, or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test elements shall be tested in accordance with ASTM D 1143 *including Procedure G: Cyclic Loading Test* or ASTM D 4945. At least one element shall be load tested in each area of uniform subsoil conditions. Where required by the building official, additional elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test element as assessed by one of the published methods listed in Section 1810A.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential settlements at design load in accordance with Section 1810A.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (e.g., net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance.

**1810A.3.3.1.3 Load test evaluation methods.** It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90% Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

**1810A.3.3.1.4 Allowable frictional resistance.** The assumed frictional resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil

material at minimum depth as set forth in Table 1806A.2, up to a maximum of 500 psf (24 kPa), unless a greater value is allowed by the building official on the basis of a geotechnical investigation as specified in Section 1803A or a greater value is substantiated by a load test in accordance with Section 1810A.3.3.1.2. Frictional resistance and bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803A.

**1810A.3.3.1.5 Uplift capacity of a single deep foundation element.** Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D 3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810A.3.3.1.2, using the results of load tests conducted in accordance with ASTM D 3689 *including the cyclic loading procedure*, divided by a factor of safety of two.

**Exception:** Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

**1810A.3.3.1.6 Uplift capacity of grouped deep foundation elements.** For grouped deep foundation elements subjected to uplift, the allowable working uplift load for the group shall be calculated by an approved method of analysis. Where the deep foundation elements in the group are placed at a center-to-center spacing of at least 2.5 times the least horizontal dimension of the largest single element, the allowable working uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual uplift working load times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

**1810A.3.3.1.7 Load-bearing capacity.** Deep foundation elements shall develop ultimate load capacities of at least twice the design working loads in the designated load-bearing layers. Analysis shall show that no soil layer underlying the designated load-bearing layers causes the load-bearing capacity safety factor to be less than two.

**1810A.3.3.1.8 Bent deep foundation elements.** The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

**1810A.3.3.1.9 Helical piles.** The allowable axial design load,  $P_a$ , of helical piles shall be determined as follows:

$$P_a = 0.5 P_u \quad \text{(Equation 18A-4)}$$

where  $P_u$  is the least value of:

1. Sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests.
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

**1810A.3.3.2 Allowable lateral load.** Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests *in accordance with ASTM D 3966, including the cyclic loading procedure*, to at least twice the proposed design working load. The resulting allowable load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

**1810A.3.4 Subsiding soils.** Where deep foundation elements are installed through subsiding fills or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces that may be imposed on the elements by the subsiding upper strata.

Where the influence of subsiding fills is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

**1810A.3.5 Dimensions of deep foundation elements.** The dimensions of deep foundation elements shall be in accordance with Sections 1810A.3.5.1 through 1810A.3.5.3, as applicable.

**1810A.3.5.1 Precast.** The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

**1810A.3.5.2 Cast-in-place or grouted-in-place.** Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

**1810A.3.5.2.1 Cased.** Cast-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

**1810A.3.5.2.2 Uncased.** Cast-in-place deep foundation elements without a permanent casing shall have a diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the average diameter.

**Exception:** The length of the element is permitted to exceed 30 times the diameter, provided the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

**1810A.3.5.2.3 Micropiles.** Micropiles shall have an outside diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810A.3.5 shall not apply to micropiles.

**1810A.3.5.3 Steel.** Steel deep foundation elements shall satisfy the requirements of this section.

**1810A.3.5.3.1 H-piles.** Sections of H-piles shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall not be less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall not be less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of  $\frac{3}{8}$  inch (9.5 mm).

**1810A.3.5.3.2 Steel pipes and tubes.** Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have a minimum of 0.34 square inch (219 mm<sup>2</sup>) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to Seismic Design Category C, D, E or F shall have a wall thickness of not less than  $\frac{3}{16}$  inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than  $\frac{3}{8}$  inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock



socket shall be approximately equal to the inside diameter of the casing.

**Exceptions:**

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be  $\frac{1}{10}$  inch (2.5 mm).

**1810A.3.5.3.3 Helical piles.** Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

**1810A.3.6 Splices.** Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810A.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

**1810A.3.6.1 Seismic Design Categories C through F.**

For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element; and
2. The axial and shear forces and moments from the load effects including overstrength factor in Section 12.4.3.2 of ASCE 7.

**1810A.3.7 Top of element detailing at cutoffs.** Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

**1810A.3.8 Precast concrete piles.** Precast concrete piles shall be designed and detailed in accordance with Sections 1810A.3.8.1 through 1810A.3.8.3.

**1810A.3.8.1 Reinforcement.** Longitudinal steel shall be arranged in a symmetrical pattern and be laterally

tied with steel ties or wire spiral spaced center to center as follows:

1. At not more than 1 inch (25 mm) for the first five ties or spirals at each end; then
2. At not more than 4 inches (102 mm), for the remainder of the first 2 feet (610 mm) from each end; and then
3. At not more than 6 inches (152 mm) elsewhere.

The size of ties and spirals shall be as follows:

1. For piles having a least horizontal dimension of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).
2. For piles having a least horizontal dimension of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage).
3. For piles having a least horizontal dimension of 20 inches (508 mm) and larger, wire shall not be smaller than  $\frac{1}{4}$  inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

**1810A.3.8.2 Precast nonprestressed piles.** Precast nonprestressed concrete piles shall comply with the requirements of Sections 1810A.3.8.2.1 through 1810A.3.8.2.3.

**1810A.3.8.2.1 Minimum reinforcement.** Longitudinal reinforcement shall consist of at least four bars with a minimum longitudinal reinforcement ratio of 0.008.

**1810A.3.8.2.2 Seismic reinforcement in Seismic Design Categories C through F.** For structures assigned to Seismic Design Category C, D, E or F, precast nonprestressed piles shall be reinforced as specified in this section. The minimum longitudinal reinforcement ratio shall be 0.01 throughout the length. Transverse reinforcement shall consist of closed ties or spirals with a minimum  $\frac{3}{8}$  inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of eight times the diameter of the smallest longitudinal bar or 6 inches (152 mm) within a distance of three times the least pile dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm) throughout the remainder of the pile.

**1810A.3.8.2.3 Additional seismic reinforcement in Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, transverse reinforcement shall be in accordance with Section 1810A.3.9.4.2.

**1810A.3.8.3 Precast prestressed piles.** Precast prestressed concrete piles shall comply with the requirements of Sections 1810A.3.8.3.1 through 1810A.3.8.3.3.

**1810A.3.8.3.1 Effective prestress.** The effective prestress in the pile shall not be less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in

length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

**1810A.3.8.3.2 Seismic reinforcement in Seismic Design Category C.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1810A.3.8.3.3 Seismic reinforcement in Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, in accordance with Section 1613A, precast prestressed piles shall have transverse reinforcement in accordance with the following:

1. Requirements in ACI 318, Chapter 21, need not apply, unless specifically referenced.
2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand or 8 inches (203 mm), whichever is smallest.
4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of each spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Section 12.14.3 of ACI 318.
5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region shall comply with the following:

$$\rho_s = 0.25(f'_c/f_{yh})(A_g/A_{ch} - 1.0) / [0.5 + 1.4P/(f'_c A_g)]$$

**(Equation 18A-6)**

but not less than

$$\rho_s = 0.12(f'_c/f_{yh}) / [0.5 + 1.4P/(f'_c A_g)] \geq 0.12f'_c/f_{yh}$$

**(Equation 18A-7)**

and need not exceed:

$$\rho_s = 0.021$$

**(Equation 18A-8)**

where:

$A_g$  = Pile cross-sectional area, square inches (mm<sup>2</sup>).

$A_{ch}$  = Core area defined by spiral outside diameter, square inches (mm<sup>2</sup>).

$f'_c$  = Specified compressive strength of concrete, psi (MPa).

$f_{yh}$  = Yield strength of spiral reinforcement  $\leq$  85,000 psi (586 MPa).

$P$  = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

$p_s$  = Volumetric ratio (vol. spiral/vol. core).

6. Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing,  $s$ , and perpendicular dimension,  $h_c$ , shall conform to:

$$A_{sh} = 0.3s h_c (f'_c/f_{yh})(A_g/A_{ch} - 1.0) / [0.5 + 1.4P/(f'_c A_g)]$$

**Equation 18-9**

but not less than:

$$A_{sh} = 0.12s h_c (f'_c/f_{yh}) [0.5 + 1.4P/(f'_c A_g)]$$

**(Equation 18-10)**

where:

$f_{yh}$  = yield strength of transverse reinforcement  $\leq$  70,000 psi (483 MPa).

$h_c$  = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).

$s$  = Spacing of transverse reinforcement measured along length of pile, inch (mm).

$A_{sh}$  = Cross-sectional area of transverse reinforcement, square inches (mm<sup>2</sup>).

$f'_c$  = Specified compressive strength of concrete, psi (MPa).

The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.

Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.

**1810A.3.9 Cast-in-place deep foundations.** Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810A.3.9.1 through 1810A.3.9.6.

**1810A.3.9.1 Design cracking moment.** The design cracking moment ( $\phi M_n$ ) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3 \sqrt{f'_c} S_m \quad (\text{Equation 18A-11})$$

where:

$f'_c$  = Specified compressive strength of concrete or grout, psi (MPa)

$S_m$  = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm<sup>3</sup>)

**1810A.3.9.2 Required reinforcement.** Where subject to uplift or where the required moment strength determined using the load combinations of Section 1605A.2 exceeds the design cracking moment determined in accordance with Section 1810A.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

**1810A.3.9.3 Placement of reinforcement.** Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

**Exceptions:**

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided the construction method can be demonstrated to the satisfaction of the building official.

**1810A.3.9.4 Seismic reinforcement.** Where a structure is assigned to Seismic Design Category C, reinforcement shall be provided in accordance with Section 1810A.3.9.4.1. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810A.3.9.4.2.

**Exceptions:**

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as

required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810A.2.1.

2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load,  $E$ , to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810A.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810A.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 12.4.3.2 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810A.2.1.
4. Closed ties or spirals where required by Section 1810A.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

**1810A.3.9.4.1 Seismic reinforcement in Seismic Design Category C.** For structures assigned to Seismic Design Category C in accordance with Section 1613A, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

A minimum of four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided for throughout the minimum reinforced length of the element as defined below starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length;
2. A distance of 10 feet (3048 mm);
3. Three times the least element dimension; and
4. The distance from the top of the element to the point where the design cracking moment

determined in accordance with Section 1810A.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605A.2.

Transverse reinforcement shall consist of closed ties or spirals with a minimum  $\frac{3}{8}$  inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

**Exceptions:**

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard gage No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

**1810A.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

A minimum of four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined below starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length;
2. A distance of 10 feet (3048 mm);
3. Three times the least element dimension; and
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810A.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605A.2.

Transverse reinforcement shall consist of closed ties or spirals no smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement,

as specified in Section 1810A.3.9.4.2.1 or 1810A.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters;
2. One-half the least dimension of the element; and
3. 12 inches (305 mm).

**Exceptions:**

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard gage No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

**1810A.3.9.4.2.1 Site Classes A through D.** For Site Class A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 21.6.4.2, 21.6.4.3 and 21.6.4.4 of ACI 318 within three times the least element dimension *at the bottom of the pile cap*. A transverse spiral reinforcement ratio of not less than one-half of that required in Section 21.6.4.4(a) of ACI 318 shall be permitted *for concrete deep foundation elements*.

**1810A.3.9.4.2.2 Site Classes E and F.** For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 21.6.4.2, 21.6.4.3 and 21.6.4.4 of ACI 318 within seven times the least element dimension *at the bottom of the pile cap* and within seven times the least element dimension *at the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay*.

**1810A.3.9.5 Belled drilled shafts.** Where drilled shafts are belled at the bottom, the edge thickness of the bell shall not be less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

**1810A.3.9.6 Socketed drilled shafts.** Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element

with a minimum safety factor of two, but the depth shall not be less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

**1810A.3.10 Micropiles.** Micropiles shall be designed and detailed in accordance with Sections 1810A.3.10.1 through 1810A.3.10.4.

**1810A.3.10.1 Construction.** Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by at least their development length in tension in accordance with ACI 318.

**1810A.3.10.2 Materials.** Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A 615 Grade 60 or 75 or ASTM A 722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of  $\frac{3}{16}$  inch (4.8 mm). Splices shall comply with Section 1810A.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

**1810A.3.10.3 Reinforcement.** For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry at least 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

**1810A.3.10.4 Seismic requirements.** For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of  $\frac{3}{8}$  inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810A.3.3 by at least two project specific preproduction tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to the load determined in accordance with Section 1615A.1.10.

*Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 21.12.4.*

*Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least  $\frac{1}{16}$  inch corrosion allowance.*

*Micropiles shall not be considered as carrying any horizontal loads.*

**1810A.3.11 Pile caps.** Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load. The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend at least 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

**1810A.3.11.1 Seismic Design Categories C through F.** For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap by embedding the element reinforcement or field-placed dowels anchored in the element into the pile cap for a distance equal to their development length in accordance with ACI 318. It shall be permitted to connect precast prestressed piles to the pile cap by developing the element prestressing strands into the pile cap provided the connection is ductile. For deformed bars, the development length is the full development length for compression, or tension in the case of uplift, without reduction for excess reinforcement in accordance with Section 12.2.5 of ACI 318. Alternative measures for laterally confining concrete and maintaining toughness and ductile-like behavior at the top of the element shall be permitted provided the design is such that any hinging occurs in the confined region.

The minimum transverse steel ratio for confinement shall not be less than one-half of that required for columns.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

**1810A.3.11.2 Seismic Design Categories D through F.** For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bend-

ing moments due to fixity to the pile cap. Anchorage shall develop a minimum of 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
  - 1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element;
  - 1.2. The nominal tensile strength of a steel element; and
  - 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

**Exception:** The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7; or shall be capable of developing the full axial, bending and shear nominal strength of the element.

Where the vertical lateral force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

**1810A.3.12 Grade beams.** For structures assigned to Seismic Design Category D, E or F, grade beams shall comply with the provisions in Section 21.12.3 of ACI 318 for grade beams, except where they are designed to resist the seismic load effects including overstrength factor in accordance with Section 12.4.3 or 12.14.3.2 of ASCE 7.

**1810A.3.13 Seismic ties.** For structures assigned to Seismic Design Category C, D, E or F, individual deep foundations shall be interconnected by ties. Unless it can be demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade or confinement by competent rock, hard cohesive soils or very dense granular soils, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger pile cap or column design gravity load times the seismic coefficient,  $S_{DS}$ , divided by 10, and 25 percent of the smaller pile or column design gravity load.

**Exception:** In Group R-3 and U occupancies of light-frame construction, deep foundation elements support-

ing foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

**1810A.4 Installation.** Deep foundations shall be installed in accordance with Section 1810A.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

**1810A.4.1 Structural integrity.** Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that may adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

**1810A.4.1.1 Compressive strength of precast concrete piles.** A precast concrete pile shall not be driven before the concrete has attained a compressive strength of at least 75 percent of the specified compressive strength ( $f'_c$ ), but not less than the strength sufficient to withstand handling and driving forces.

**1810A.4.1.2 Casing.** Where cast-in-place deep foundation elements are formed through unstable soils and concrete is placed in an open-drilled hole, a casing shall be inserted in the hole prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

**1810A.4.1.3 Driving near uncased concrete.** Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If the concrete surface in any completed element rises or drops, the element shall be replaced. Driven uncased deep foundation elements shall not be installed in soils that could cause heave.

**1810A.4.1.4 Driving near cased concrete.** Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

**1810A.4.1.5 Defective timber piles.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1810A.4.2 Identification.** Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

**1810A.4.3 Location plan.** A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

**1810A.4.4 Preexcavation.** The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be driven below the preexcavated depth until the required resistance or penetration is obtained.

**1810A.4.5 Vibratory driving.** Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810A.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

**1810A.4.6 Heaved elements.** Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810A.3.3.1.2.

**1810A.4.7 Enlarged base cast-in-place elements.** Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

**1810A.4.8 Hollow-stem augered, cast-in-place elements.** Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be

redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

**1810A.4.9 Socketed drilled shafts.** The rock socket and pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

**1810A.4.10 Micropiles.** Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to assure grout coverage outside the casing.

**1810A.4.11 Helical piles.** Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the maximum allowable installation torque of the helical pile.

**1810A.4.12 Special inspection.** Special inspections in accordance with Sections 1704A.8 and 1704A.9 shall be provided for driven and cast-in-place deep foundation ele-

ments, respectively. Special inspections in accordance with Section 1704A.10 shall be provided for helical piles.

### **SECTION 1811A PRESTRESSED ROCK AND SOIL FOUNDATION ANCHORS**

**1811A.1 General.** *The requirements of this section address the use of vertical rock and soil anchors in resisting seismic or wind overturning forces resulting in tension on shallow foundations.*

**1813A.2 Adoption.** *Except for the modifications as set forth in Sections 1811A.3 and 1811A.4, all prestressed rock and soil foundation anchors shall be designed in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors.*

**1811A.3 Geotechnical requirements.** *Geotechnical report for the prestressed rock and soil foundation anchors shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tendon.*
3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress.*
5. *Anchor axial tension stiffness recommendations at the anticipated anchor axial tension displacements, when required for structural analysis.*
6. *Minimum grout pressure for installation and post-grout pressure.*
7. *Class I Corrosion Protection is required for all permanent anchors. Geotechnical report shall specify the corrosion protection recommendations for temporary anchors.*
8. *Performance test shall be at a minimum of 1.6 times the design loads. There shall be a minimum of two preproduction test anchors. Preproduction test anchors shall be tested to ultimate load or 0.80 times the specified minimum tensile strength of the tendon. A creep test is required for all prestressed anchors with greater than 10 kips of lock-off prestressing load.*
9. *Lock-off prestressing load requirements.*
10. *Acceptable drilling methods.*
11. *Geotechnical observation and monitoring requirements.*

#### **1811A.4 Structural Requirements.**

1. *Tendons shall be thread-bar anchors conforming to ASTM A 722.*
2. *The anchors shall be placed vertical.*

3. *Design loads shall be based upon the load combinations in Section 1605A.3.1 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
4. *Ultimate load shall be based upon Section 1615A.1.10 and shall not exceed 80 percent of the specified minimum tensile strength of the tendons.*
5. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge by group effect.*
6. *Foundation design shall incorporate the effect of lock-off loads.*
7. *Design shall account for as-built locations of soil anchors considering all the acceptable construction tolerances.*
8. *Design shall account for both short and long term deformation.*
9. *Enforcement agency may require consideration of anchor deformation in evaluating deformation compatibility or building drift where it may be significant.*





## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 19 – CONCRETE

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter											X									
Adopt entire chapter as amended (amended sections listed below)	X		X	X				X												
Adopt only those sections that are listed below																				
Chapter / Section																				
1901.1.1								X												
1901.1.2								X												
1901.1.3								X												
> 1901.1.4								X												
1905.1.2	X																			
1905.1.3	X																			
1905.1.9	X		X	X																
1907.1.1			X	X																
1908.1.1										X										
1909.1.1										X										
1909.1.2										X										
1909.2 & subsections										X										
1913.1.1								X												
1913.2								X												
1913.2.1								X												
1913.2.2								X												
1913.2.3								X												
1913.2.4								X												
1913.2.5								X												
1913.2.6								X												
1913.2.7								X												
1913.2.8								X												
1913.2.9								X												
1913.2.10								X												
1913.2.11								X												
1913.2.11.1								X												
1913.2.11.2								X												
1913.2.11.3								X												
1913.2.11.4								X												
> 1913.2.11.5								X												
> 1613.3.1								X												
> 1613.3.2								X												
1613.3.3								X												
1613.3.4								X												
1613.3.5								X												
1613.3.6								X												
> 1613.3.7								X												
1913.3.8								X												

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 19 – CONCRETE — continued

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
1913.4.1								X												
1913.4.2								X												
1913.4.3								X												
1913.4.4								X												
1913.4.5								X												
1913.5								X												

## CHAPTER 19

# CONCRETE

*Italics are used for text within Sections 1903 through 1905 of this code to indicate provisions that differ from ACI 318.*

### SECTION 1901 GENERAL

**1901.1 Scope.** The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

**1901.1.1 Application.** *The scope of application of Chapter 19 is as follows:*

*Community college buildings regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC), as listed in Section 1.9.2.2.*

**1901.1.2 Amendments in this chapter.** *DSA-SS/CC adopts this chapter and all amendments.*

**Exceptions:** *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

*Division of the State Architect—Structural Safety/Community Colleges:*

**[DSA-SS/CC]** *For applications listed in Section 1.9.2.2.*

**1901.1.3 Reference to other chapters.** *[DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A, and 18A respectively shall apply instead.*

**1901.1.4 Amendments.** *[DSA-SS/CC] See Section 1913 for additional requirements applicable to community colleges.*

**1901.2 Plain and reinforced concrete.** Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.

**1901.3 Construction documents.** The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.

8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for post-tensioning tendons.
11. For structures assigned to *Seismic Design Category D, E or F*, a statement if slab on grade is designed as a structural diaphragm.

**1901.4 Special inspection.** The special inspection of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17.

### SECTION 1902 DEFINITIONS

**1902.1 General.** The words and terms defined in ACI 318 shall, for the purposes of this chapter and as used elsewhere in this code for concrete construction, have the meanings shown in ACI 318 as modified by Section 1905.1.1.

### SECTION 1903 SPECIFICATIONS FOR TESTS AND MATERIALS

**1903.1 General.** Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318. *Where required, special inspections and tests shall be in accordance with Chapter 17.*

**1903.2 Glass fiber reinforced concrete.** *Glass fiber reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.*

**1903.3 Flat wall insulating concrete form (ICF) systems.** *Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E 2634.*

### SECTION 1904 DURABILITY REQUIREMENTS

**1904.1 Exposure categories and classes.** Concrete shall be assigned to exposure classes in accordance with the durability requirements of ACI 318 based on:

1. Exposure to freezing and thawing in a moist condition or deicer chemicals;
2. Exposure to sulfates in water or soil;
3. Exposure to water where the concrete is intended to have low permeability; and
4. Exposure to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater or spray from these sources, where the concrete has steel reinforcement.

**1904.2 Concrete properties.** Concrete mixtures shall conform to the most restrictive maximum water-cementitious materials ratios, maximum cementitious admixtures, minimum air-entrainment and minimum specified concrete compressive strength requirements of ACI 318 based on the exposure classes assigned in Section 1904.1.

**Exception:** For occupancies and appurtenances thereto in Group R occupancies that are in buildings less than four stories above grade plane, normal-weight aggregate concrete is permitted to comply with the requirements of Table 1904.2 based on the weathering classification (freezing and thawing) determined from Figure 1904.2 in lieu of the durability requirements of ACI 318.

## SECTION 1905 MODIFICATIONS TO ACI 318

**1905.1 General.** The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through 1905.1.10.

**1905.1.1 ACI 318, Section 2.2.** Modify existing definitions and add the following definitions to ACI 318, Section 2.2.

**DESIGN DISPLACEMENT.** Total lateral displacement expected for the design-basis earthquake, as specified by Section 12.8.6 of ASCE 7.

**DETAILED PLAIN CONCRETE STRUCTURAL WALL.** A wall complying with the requirements of Chapter 22, including 22.6.7.

**ORDINARY PRECAST STRUCTURAL WALL.** A precast wall complying with the requirements of Chapters 1 through 18.

**ORDINARY REINFORCED CONCRETE STRUCTURAL WALL.** A cast-in-place wall complying with the requirements of Chapters 1 through 18.

**ORDINARY STRUCTURAL PLAIN CONCRETE WALL.** A wall complying with the requirements of Chapter 22, excluding 22.6.7.

**SPECIAL STRUCTURAL WALL.** A cast-in-place or precast wall complying with the requirements of 21.1.3 through 21.1.7, 21.9 and 21.10, as applicable, in addition to the requirements for ordinary reinforced concrete structural walls or ordinary precast structural walls, as applicable. Where ASCE 7 refers to a "special reinforced concrete structural wall," it shall be deemed to mean a "special structural wall."

**WALL PIER.** A wall segment with a horizontal length-to-thickness ratio of at least 2.5, but not exceeding 6, whose clear height is at least two times its horizontal length.

**1905.1.2 ACI 318, Section 21.1.1.** Modify ACI 318 Sections 21.1.1.3 and 21.1.1.7 to read as follows:

*21.1.1.3 - Structures assigned to Seismic Design Category A shall satisfy requirements of Chapters 1 to 19 and 22; Chapter 21 does not apply. Structures assigned to Seismic Design Category B, C, D, E or F also shall satisfy 21.1.1.4 through 21.1.1.8, as applicable. Except for structural elements of plain concrete complying with Section 1905.1.8 of the California Building Code, struc-*

*tural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E or F.*

*21.1.1.7 - Structural systems designated as part of the seismic force-resisting system shall be restricted to those permitted by ASCE 7. Except for Seismic Design Category A, for which Chapter 21 does not apply, the following provisions shall be satisfied for each structural system designated as part of the seismic force-resisting system, regardless of the Seismic Design Category:*

- (a) Ordinary moment frames shall satisfy 21.2.
- (b) Ordinary reinforced concrete structural walls and ordinary precast structural walls need not satisfy any provisions in Chapter 21.
- (c) Intermediate moment frames shall satisfy 21.3.
- (d) Intermediate precast structural walls shall satisfy 21.4.
- (e) Special moment frames shall satisfy 21.5 through 21.8.
- (f) Special structural walls shall satisfy 21.9.
- (g) Special structural walls constructed using precast concrete shall satisfy 21.10.

All special moment frames and special structural walls shall also satisfy 21.1.3 through 21.1.7.

**1905.1.3 ACI 318, Section 21.4.** Modify ACI 318, Section 21.4, by renumbering Section 21.4.3 to become 21.4.4 and adding new Sections 21.4.3, 21.4.5, 21.4.6 and 21.4.7 to read as follows:

*21.4.3 - Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the deformation induced by the design displacement or shall use Type 2 mechanical splices.*

*21.4.4 - Elements of the connection that are not designed to yield shall develop at least  $1.5 S_y$ .*

*21.4.5 - Wall piers in Seismic Design Category D, E or F shall comply with Section 1905.1.4 of the California Building Code.*

*21.4.6 - Wall piers not designed as part of a moment frame in buildings assigned to Seismic Design Category C shall have transverse reinforcement designed to resist the shear forces determined from 21.3.3. Spacing of transverse reinforcement shall not exceed 8 inches (203 mm). Transverse reinforcement shall be extended beyond the pier clear height for at least 12 inches (305 mm).*

### Exceptions:

1. Wall piers that satisfy 21.13.
2. Wall piers along a wall line within a story where other shear wall segments provide lateral support to the wall piers and such segments have a total stiffness of at least six times the sum of the stiffnesses of all the wall piers.

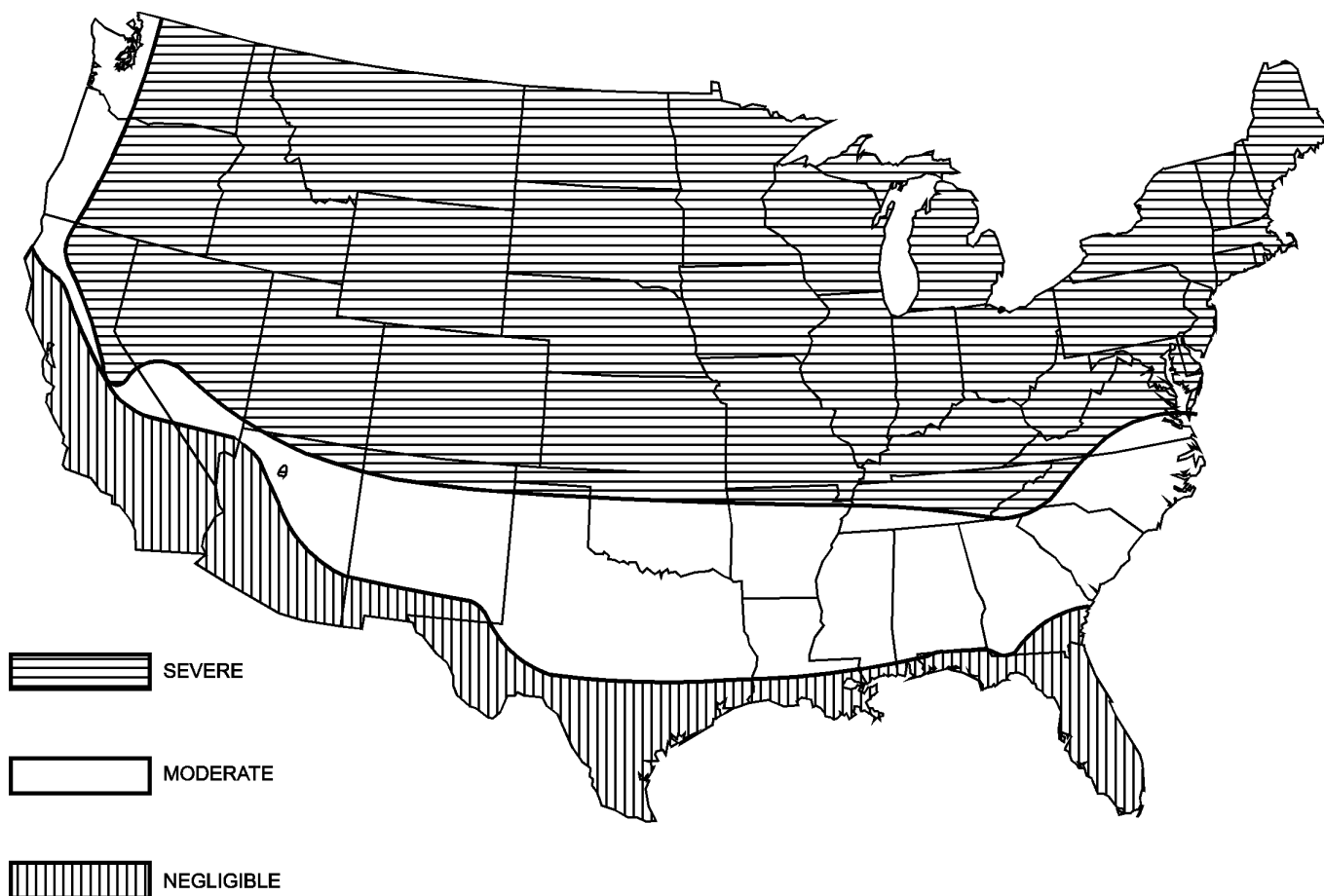
*21.4.7 - Wall segments with a horizontal length-to-thickness ratio less than 2.5 shall be designed as columns.*

**TABLE 1904.2**  
**MINIMUM SPECIFIED COMPRESSIVE STRENGTH ( $f'_c$ )**

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH ( $f'_c$ at 28 days, psi)		
	Negligible exposure	Moderate exposure	Severe exposure
Basement walls <sup>c</sup> and foundations not exposed to the weather	2,500	2,500	2,500 <sup>a</sup>
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 <sup>a</sup>
Basement walls <sup>c</sup> , foundation walls, exterior walls and other vertical concrete surfaces exposed to the weather	2,500	3,000 <sup>b</sup>	3,000 <sup>b</sup>
Driveways, curbs, walks, patios, porches, carport slabs, steps and other flatwork exposed to the weather, and garage floor slabs	2,500	3,000 <sup>b, d</sup>	3,500 <sup>b, d</sup>

For SI: 1 pound per square inch = 0.00689 MPa.

- a. Concrete in these locations that can be subjected to freezing and thawing during construction shall be of air-entrained concrete in accordance with Section 1904.2.
- b. Concrete shall be air entrained in accordance with ACI 318.
- c. Structural plain concrete basement walls are exempt from the requirements for exposure conditions of Section 1904.2.
- d. For garage floor slabs where a steel trowel finish is used, the total air content required by ACI 318 is permitted to be reduced to not less than 3 percent, provided the minimum specified compressive strength of the concrete is increased to 4,000 psi.



**FIGURE 1904.2**  
**WEATHERING PROBABILITY MAP FOR CONCRETE<sup>a, b, c</sup>**

- a. Lines defining areas are approximate only. Local areas can be more or less severe than indicated by the region classification.
- b. A "severe" classification is where weather conditions encourage or require the use of deicing chemicals or where there is potential for a continuous presence of moisture during frequent cycles of freezing and thawing. A "moderate" classification is where weather conditions occasionally expose concrete in the presence of moisture to freezing and thawing, but where deicing chemicals are not generally used. A "negligible" classification is where weather conditions rarely expose concrete in the presence of moisture to freezing and thawing.
- c. Alaska and Hawaii are classified as severe and negligible, respectively.

**1905.1.4 ACI 318, Section 21.9.** Modify ACI 318, Section 21.9, by deleting Section 21.9.8 and replacing with the following:

21.9.8 - Wall piers and wall segments.

21.9.8.1 - Wall piers not designed as a part of a special moment frame shall have transverse reinforcement designed to satisfy the requirements in 21.9.8.2.

**Exceptions:**

1. Wall piers that satisfy 21.13.
2. Wall piers along a wall line within a story where other shear wall segments provide lateral support to the wall piers and such segments have a total stiffness of at least six times the sum of the stiffnesses of all the wall piers.

21.9.8.2 - Transverse reinforcement with seismic hooks at both ends shall be designed to resist the shear forces determined from 21.6.5.1. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm). Transverse reinforcement shall be extended beyond the pier clear height for at least 12 inches (305 mm).

21.9.8.3 - Wall segments with a horizontal length-to-thickness ratio less than 2.5 shall be designed as columns.

**1905.1.5 ACI 318, Section 21.10.** Modify ACI 318, Section 21.10.2, to read as follows:

21.10.2 - Special structural walls constructed using precast concrete shall satisfy all the requirements of 21.9 for cast-in-place special structural walls in addition to Sections 21.4.2 through 21.4.4.

**1905.1.6 ACI 318, Section 21.12.1.1.** Modify ACI 318, Section 21.12.1.1, to read as follows:

21.12.1.1 - Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and ground shall comply with the requirements of Section 21.12 and other applicable provisions of ACI 318 unless modified by Chapter 18 of the California Building Code.

**1905.1.7 ACI 318, Section 22.6.** Modify ACI 318, Section 22.6, by adding new Section 22.6.7 to read as follows:

22.6.7 - Detailed plain concrete structural walls.

22.6.7.1 - Detailed plain concrete structural walls are walls conforming to the requirements of ordinary structural plain concrete walls and 22.6.7.2.

22.6.7.2 - Reinforcement shall be provided as follows:

- (a) Vertical reinforcement of at least 0.20 square inch (129 mm<sup>2</sup>) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening and at the ends of walls. The continuous vertical bar required beside an opening is permitted

to substitute for one of the two No. 5 bars required by 22.6.6.5.

- (b) Horizontal reinforcement at least 0.20 square inch (129 mm<sup>2</sup>) in cross-sectional area shall be provided:

1. Continuously at structurally connected roof and floor levels and at the top of walls;
2. At the bottom of load-bearing walls or in the top of foundations where doweled to the wall; and
3. At a maximum spacing of 120 inches (3048 mm).

Reinforcement at the top and bottom of openings, where used in determining the maximum spacing specified in Item 3 above, shall be continuous in the wall.

**1905.1.8 ACI 318, Section 22.10.** Delete ACI 318, Section 22.10, and replace with the following:

22.10 - Plain concrete in structures assigned to Seismic Design Category C, D, E or F.

22.10.1 - Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete, except as follows:

- (a) Structural plain concrete basement, foundation or other walls below the base are permitted in detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls. In dwellings assigned to Seismic Design Category D or E, the height of the wall shall not exceed 8 feet (2438 mm), the thickness shall not be less than 7½ inches (190 mm), and the wall shall retain no more than 4 feet (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with 22.6.6.5.
- (b) Isolated footings of plain concrete supporting pedestals or columns are permitted, provided the projection of the footing beyond the face of the supported member does not exceed the footing thickness.

**Exception:** In detached one- and two-family dwellings three stories or less in height, the projection of the footing beyond the face of the supported member is permitted to exceed the footing thickness.

- (c) Plain concrete footings supporting walls are permitted, provided the footings have at least two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 4 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing. For footings that exceed 8 inches (203 mm) in

thickness, a minimum of one bar shall be provided at the top and bottom of the footing. Continuity of reinforcement shall be provided at corners and intersections.

**Exceptions:**

1. In Seismic Design Categories A, B and C, detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls, are permitted to have plain concrete footings without longitudinal reinforcement.
2. For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, a minimum of one bar shall be provided at the top of the stemwall and at the bottom of the footing.
3. Where a slab on ground is cast monolithically with the footing, one No. 5 bar is permitted to be located at either the top of the slab or bottom of the footing.

**1905.1.9 ACI 318, Section D.3.3.** Modify ACI 318, Sections D.3.3.4.2, D.3.3.4.3(d) and D.3.3.5.2 to read as follows:

*D.3.3.4.2 - Where the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with Section D.3.3.4.3. The anchor design tensile strength shall be determined in accordance with Section D.3.3.4.4.*

**Exception:** Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 and Section 1604A.8.2 of this code shall be deemed to satisfy Section D.3.3.4.3(d).

*D.3.3.4.3(d) - The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E, with E increased by  $\Omega_e$ . The anchor design tensile strength shall be calculated from Section D.3.3.4.4*

*D.3.3.5.2 - Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with Section D.3.3.5.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with Section D.6.*

**Exceptions:**

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill

plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane design shear strength in accordance with Sections D.6.2 and D.6.3 need not be computed and Section D.3.3.5.3 shall be deemed to be satisfied provided all of the following are met:

- 1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.
- 1.2. The maximum anchor nominal diameter is  $\frac{5}{8}$  inches (16 mm).
- 1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).
- 1.4. Anchor bolts are located a minimum of  $1\frac{3}{4}$  inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.
- 1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.
- 1.6. The sill plate is 2-inch or 3-inch nominal thickness.
2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls the in-plane design shear strength in accordance with Sections D.6.2 and D.6.3 need not be computed and Section D.3.3.5.3 shall be deemed to be satisfied provided all of the following are met:
  - 2.1. The maximum anchor nominal diameter is  $\frac{5}{8}$  inches (16 mm).
  - 2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).
  - 2.3. Anchors are located a minimum of  $1\frac{3}{4}$  inches (45 mm) from the edge of the concrete parallel to the length of the track.
  - 2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.
  - 2.5. The track is 33 to 68 mil designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100 Section E3.3.1.
3. In light-frame construction, bearing or nonbearing walls, shear strength of concrete



anchors less than or equal to  $\frac{5}{8}$  inch (16 mm) in diameter of sill plate or track to foundation or foundation stem wall need not satisfy Section D.3.3.5.3 (a) through (c) when the design strength of the anchors is determined in accordance with Section D.6.2.1(c).

## SECTION 1906 STRUCTURAL PLAIN CONCRETE

**1906.1 Scope.** The design and construction of structural plain concrete, both cast-in-place and precast, shall comply with the minimum requirements of ACI 318, as modified in Section 1905.

**Exception:** For Group R-3 occupancies and buildings of other occupancies less than two stories above grade plane of light-frame construction, the required footing thickness of ACI 318 is permitted to be reduced to 6 inches (152 mm), provided that the footing does not extend more than 4 inches (102 mm) on either side of the supported wall.

## SECTION 1907 MINIMUM SLAB PROVISIONS

**1907.1 General.** The thickness of concrete floor slabs supported directly on the ground shall not be less than  $3\frac{1}{2}$  inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

**Exception:** A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m<sup>2</sup>) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork which will not be enclosed at a later date.
5. Where approved based on local site conditions.

**1907.1.1 [HCD 1] Capillary break.** When a vapor retarder is required, a capillary break shall be installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.

## SECTION 1908 ANCHORAGE TO CONCRETE— ALLOWABLE STRESS DESIGN

**1908.1 Scope.** The provisions of this section shall govern the allowable stress design of headed bolts and headed stud anchors cast in normal-weight concrete for purposes of transmitting structural loads from one connected element to the other. These provisions do not apply to anchors installed in hardened concrete or where load combinations include earthquake loads or effects. The bearing area of headed anchors shall be not less than one and one-half times the shank area. Where strength design is used, or where load combinations include earthquake loads or effects, the design strength of anchors shall be determined in accordance with Section 1909. Bolts shall conform to ASTM A 307 or an approved equivalent.

**1908.1.1 Power Actuated Fasteners. [OSHDP 2]** Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of this section.

Power actuated fasteners shall be permitted in seismic shear for components exempt from construction documents review by ASCE 7 Section 13.1.4 and for interior nonbearing nonshear wall partitions. Power actuated fastener shall not be used to anchor exterior cladding or curtain wall systems.

**1908.2 Allowable service load.** The allowable service load for headed anchors in shear or tension shall be as indicated in Table 1908.2. Where anchors are subject to combined shear and tension, the following relationship shall be satisfied:

$$(P_s / P_t)^{5/3} + (V_s / V_t)^{5/3} \leq 1 \quad \text{(Equation 19-1)}$$

where:

$P_s$  = Applied tension service load, pounds (N).

$P_t$  = Allowable tension service load from Table 1908.2, pounds (N).

$V_s$  = Applied shear service load, pounds (N).

$V_t$  = Allowable shear service load from Table 1908.2, pounds (N).

**1908.3 Required edge distance and spacing.** The allowable service loads in tension and shear specified in Table 1908.2 are for the edge distance and spacing specified. The edge distance and spacing are permitted to be reduced to 50 percent of the values specified with an equal reduction in allowable service load. Where edge distance and spacing are reduced less than 50 percent, the allowable service load shall be determined by linear interpolation.

**1908.4 Increase in allowable load.** Increase of the values in Table 1908.2 by one-third is permitted where the provisions of Section 1605.3.2 permit an increase in allowable stress for wind loading.

**1908.5 Increase for special inspection.** Where special inspection is provided for the installation of anchors, a 100-percent increase in the allowable tension values of Table 1908.2 is permitted. No increase in shear value is permitted.

**TABLE 1908.2**  
**ALLOWABLE SERVICE LOAD ON EMBEDDED BOLTS (pounds)**

BOLT DIAMETER (inches)	MINIMUM EMBEDMENT (inches)	EDGE DISTANCE (inches)	SPACING (inches)	MINIMUM CONCRETE STRENGTH (psi)					
				$f'_c = 2,500$		$f'_c = 3,000$		$f'_c = 4,000$	
				Tension	Shear	Tension	Shear	Tension	Shear
$1/4$	$2\frac{1}{2}$	$1\frac{1}{2}$	3	200	500	200	500	200	500
$3/8$	3	$2\frac{1}{4}$	$4\frac{1}{2}$	500	1,100	500	1,100	500	1,100
$1/2$	4	3	6	950	1,250	950	1,250	950	1,250
	4	5	6	1,450	1,600	1,500	1,650	1,550	1,750
$5/8$	$4\frac{1}{2}$	$3\frac{3}{4}$	$7\frac{1}{2}$	1,500	2,750	1,500	2,750	1,500	2,750
	$4\frac{1}{2}$	$6\frac{1}{4}$	$7\frac{1}{2}$	2,125	2,950	2,200	3,000	2,400	3,050
$3/4$	5	$4\frac{1}{2}$	9	2,250	3,250	2,250	3,560	2,250	3,560
	5	$7\frac{1}{2}$	9	2,825	4,275	2,950	4,300	3,200	4,400
$7/8$	6	$5\frac{1}{4}$	$10\frac{1}{2}$	2,550	3,700	2,550	4,050	2,550	4,050
1	7	6	12	3,050	4,125	3,250	4,500	3,650	5,300
$1\frac{1}{8}$	8	$6\frac{3}{4}$	$13\frac{1}{2}$	3,400	4,750	3,400	4,750	3,400	4,750
$1\frac{1}{4}$	9	$7\frac{1}{2}$	15	4,000	5,800	4,000	5,800	4,000	5,800

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound = 4.45 N.

### SECTION 1909 ANCHORAGE TO CONCRETE— STRENGTH DESIGN

**1909.1 Scope.** The provisions of this section shall govern the strength design of anchors installed in concrete for purposes of transmitting structural loads from one connected element to the other. Headed bolts, headed studs and hooked (J- or L-) bolts cast in concrete and expansion anchors and undercut anchors installed in hardened concrete shall be designed in accordance with Appendix D of ACI 318 as modified by Sections 1905.1.9 and 1905.1.10, provided they are within the scope of Appendix D.

The strength design of anchors that are not within the scope of Appendix D of ACI 318, and as amended in Sections 1905.1.9 and 1905.1.10, shall be in accordance with an approved procedure.

**1909.1.1 Mechanical anchors and specialty inserts.** [OSHPD 2] Mechanical anchors qualified in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section.

Specialty inserts, including cast-in-place specialty inserts, tested in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section.

**1909.1.2 Post-installed adhesive anchors.** [OSHPD 2] Adhesive anchors qualified in accordance with ICC-ES AC 308 shall be deemed to satisfy the requirements of this section.

**1909.2 Tests for Post-installed anchors in concrete.** [OSHPD 2] When post-installed anchors are used in lieu of cast-in place bolts, the installation verification test loads, frequency and acceptance criteria shall be in accordance with this section.

**1909.2.1 General.** Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

**1909.2.2 Test loads.** Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter ( $1\frac{1}{4}$ ) times the maximum design strength of anchors as provided in approved test report using criteria adopted in this code or determined in accordance with Appendix D of ACI 318.

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ( $= 0.8 A_{se} f_{ya}$ ).

2. The manufacturer's recommended installation torque based on approved test report using criteria adopted in this code.

**1909.2.3 Test frequency.** When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

**Exceptions:**

1. Undercut anchors that allow visual confirmation of full set shall not require testing.

2. Where the factored design tension on anchors is less than 100 lbs and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all of the following conditions are met:
  - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
  - b. The number of dowels in any one member equals or exceeds twelve (12).
  - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors, and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).

4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.

**1909.2.4 Test acceptance criteria.** Acceptance criteria for post-installed anchors shall be based on approved test report using criteria adopted in this code. Field test shall satisfy following minimum requirements.

**1. Hydraulic ram method:**

Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

For adhesive anchors, where other than bond is being tested, the testing device shall not restrict the concrete shear cone type failure mechanism from occurring.

**2. Torque wrench method:**

Anchors tested with a calibrated torque wrench must attain the specified torque within  $1/2$  turn of the nut.

**Exceptions:**

- a. Wedge or sleeve type:  
One-quarter ( $1/4$ ) turn of the nut for a  $3/8$  in. sleeve anchor only.
- b. Threaded Type:  
One-quarter ( $1/4$ ) turn of the screw after initial seating of the screw head.

**1909.2.5 Testing procedure.** Test procedure shall be as permitted by approved test report using criteria adopted in this code. Torque controlled post-installed anchors shall be permitted to be tested using torque based on approved

test report using criteria adopted in this code. All other post-installed anchors shall be tension tested. Manufacturer's recommendation for testing may be approved by the enforcement agency based on approved test report using criteria adopted in this code.

## SECTION 1910 SHOTCRETE

**1910.1 General.** Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for plain or reinforced concrete.

**1910.2 Proportions and materials.** Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in finished in-place hardened shotcrete meeting the strength requirements of this code.

**1910.3 Aggregate.** Coarse aggregate, if used, shall not exceed  $3/4$  inch (19.1 mm).

**1910.4 Reinforcement.** Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1910.4.1 through 1910.4.4.

**1910.4.1 Size.** The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.

**1910.4.2 Clearance.** When No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of  $2\frac{1}{2}$  inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. When two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

**Exception:** Subject to the approval of the building official, required clearances shall be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.

**1910.4.3 Splices.** Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of 2 inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted when approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.

**1910.4.4 Spirally tied columns.** Shotcrete shall not be applied to spirally tied columns.

**1910.5 Preconstruction tests.** When required by the building official, a test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The sample panel shall be representative of the project and

simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official.

**1910.6 Rebound.** Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.

**1910.7 Joints.** Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

**1910.8 Damage.** In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

**1910.9 Curing.** During the curing periods specified herein, shotcrete shall be maintained above 40°F (4°C) and in moist condition.

**1910.9.1 Initial curing.** Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

**1910.9.2 Final curing.** Final curing shall continue for seven days after shotcreting, or for three days if high-early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with an approved moisture-retaining cover.

**1910.9.3 Natural curing.** Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent, and is authorized by the registered design professional and approved by the building official.

**1910.10 Strength tests.** Strength tests for shotcrete shall be made by an approved agency on specimens that are representative of the work and which have been water soaked for at least 24 hours prior to testing. When the maximum-size aggregate is larger than  $\frac{3}{8}$  inch (9.5 mm), specimens shall consist of not less than three 3-inch-diameter (76 mm) cores or 3-inch (76 mm) cubes. When the maximum-size aggregate is  $\frac{3}{8}$  inch (9.5 mm) or smaller, specimens shall consist of not less than 2-inch-diameter (51 mm) cores or 2-inch (51 mm) cubes.

**1910.10.1 Sampling.** Specimens shall be taken from the in-place work or from test panels, and shall be taken at least once each shift, but not less than one for each 50 cubic yards (38.2 m<sup>3</sup>) of shotcrete.

**1910.10.2 Panel criteria.** When the maximum-size aggregate is larger than  $\frac{3}{8}$  inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). When the maximum size aggregate is  $\frac{3}{8}$  inch (9.5 mm) or smaller, the test panels shall have minimum dimensions of 12 inches by 12 inches (305 mm by 305 mm). Panels shall be shot in the same position as the work, during the course of the work and by the nozzlemen doing the work. The conditions under which the panels are cured shall be the same as the work.

**1910.10.3 Acceptance criteria.** The average compressive strength of three cores from the in-place work or a single test panel shall equal or exceed  $0.85 f'_c$  with no single core less than  $0.75 f'_c$ . The average compressive strength of three cubes taken from the in-place work or a single test panel shall equal or exceed  $f'_c$  with no individual cube less than  $0.88 f'_c$ . To check accuracy, locations represented by erratic core or cube strengths shall be retested.

## SECTION 1911 REINFORCED GYPSUM CONCRETE

**1911.1 General.** Reinforced gypsum concrete shall comply with the requirements of ASTM C 317 and ASTM C 956.

**1911.2 Minimum thickness.** The minimum thickness of reinforced gypsum concrete shall be 2 inches (51 mm) except the minimum required thickness shall be reduced to 1½ inches (38 mm), provided the following conditions are satisfied:

1. The overall thickness, including the formboard, is not less than 2 inches (51 mm).
2. The clear span of the gypsum concrete between supports does not exceed 33 inches (838 mm).
3. Diaphragm action is not required.
4. The design live load does not exceed 40 pounds per square foot (psf) (1915 Pa).

## SECTION 1912 CONCRETE-FILLED PIPE COLUMNS

**1912.1 General.** Concrete-filled pipe columns shall be manufactured from standard, extra-strong or double-extra-strong steel pipe or tubing that is filled with concrete so placed and manipulated as to secure maximum density and to ensure complete filling of the pipe without voids.

**1912.2 Design.** The safe supporting capacity of concrete-filled pipe columns shall be computed in accordance with the approved rules or as determined by a test.

**1912.3 Connections.** Caps, base plates and connections shall be of approved types and shall be positively attached to the shell and anchored to the concrete core. Welding of brackets without mechanical anchorage shall be prohibited. Where the pipe is slotted to accommodate webs of brackets or other connections, the integrity of the shell shall be restored by welding to ensure hooping action of the composite section.

**1912.4 Reinforcement.** To increase the safe load-supporting capacity of concrete-filled pipe columns, the steel reinforce-

ment shall be in the form of rods, structural shapes or pipe embedded in the concrete core with sufficient clearance to ensure the composite action of the section, but not nearer than 1 inch (25 mm) to the exterior steel shell. Structural shapes used as reinforcement shall be milled to ensure bearing on cap and base plates.

**1912.5 Fire-resistance-rating protection.** Pipe columns shall be of such size or so protected as to develop the required fire-resistance ratings specified in Table 601. Where an outer steel shell is used to enclose the fire protective covering, the shell shall not be included in the calculations for strength of the column section. The minimum diameter of pipe columns shall be 4 inches (102 mm) except that in structures of Type V construction not exceeding three stories above grade plane or 40 feet (12 192 mm) in building height, pipe columns used in basements and as secondary steel members shall have a minimum diameter of 3 inches (76 mm).

**1912.6 Approvals.** Details of column connections and splices shall be shop fabricated by approved methods and shall be approved only after tests in accordance with the approved rules. Shop-fabricated concrete-filled pipe columns shall be inspected by the building official or by an approved representative of the manufacturer at the plant.

## SECTION 1913 ADDITIONAL REQUIREMENTS [DSA-SS/CC]

### 1913.1 General.

- || **1913.1.1 Construction documents.** Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.

**1913.2 Tests and materials.** Where required, special inspections and tests shall be in accordance with Chapter 17A and this section.

**1913.2.1 Glass fiber reinforced concrete.** Glass fiber reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.

**1913.2.2 Fly ash.** Replace ACI 318 Section 3.2.2 as follows:

*Fly ash or other pozzolan can be used as a partial substitute for ASTM C 150 portland cement, as follows:*

1. Fly ash or other pozzolan shall conform to ASTM C 618 for Class N or Class F materials (Class C is not permitted), and
2. More than 15 percent by weight of fly ash or other pozzolans shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 5.3. See Section 1904 for durability requirements.
3. More than 40 percent by weight of ground-granulated blast-furnace slag conforming to ASTM C 989 shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 5.3. See Section 1904 for durability requirements.

**1913.2.3 ACI 318, Section 3.3.2.** Modify ACI 318 Section 3.3.2 by adding the following:

*Aggregate size limitations waiver shall be approved by the enforcement agency.*

*Evidence that the aggregate used is not reactive in the presence of cement alkalis may be required by the enforcement agency. If new aggregate sources are to be used or if past experience indicates problems with existing aggregate sources, test the aggregate for potential reactivity according to ASTM C 289 to determine potential reactivity in the presence of cement.*

*If the results of the test are other than innocuous, selected concrete proportions using the aggregate (see Section 1905.2) shall be tested in accordance with ASTM C 1567. If the results of this test indicate an expansion greater than 0.10 percent at 16-days age, provide mitigation with one of the cementitious material systems noted below such that an expansion of less than 0.10 percent at 16-days age is obtained:*

1. Low-alkali portland cement containing not more than 0.6 percent total alkali when calculated as sodium oxide, as determined by the method given in ASTM C 114.
2. Blended hydraulic cement, Type IS or IP, conforming to ASTM C 595, except that Type IS cement shall not contain less than 40 percent slag constituent.
3. Replacement of not less than 15 percent by weight of the portland cement used by a mineral admixture conforming to ASTM C 618 for Class N or F materials (Class C is not permitted).
4. Replacement of not less than 40 percent by weight of the portland cement used by a ground granulated blast-furnace slag conforming to ASTM C 989.

**1913.2.4 Discontinuous steel fibers** - Modify ACI 318 Section 3.5.1 by adding the following:

*Discontinuous steel fibers shall not be permitted*

**1913.2.5 Cementitious material.** The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C 150 for portland cement and ASTM C 595 or ASTM C 1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C 618 or ASTM C 989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used.

**1913.2.6 Tests of reinforcing bars.** Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number and provided the mill analyses accompany the report, one tensile test and one

bend test shall be made from a specimen from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2½ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings provided certified mill test reports are provided for each shipment of such reinforcement.

**1913.2.7 Tests for prestressing steel and anchorage.** All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the job site. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site shall be furnished by the contractor and tested by an approved independent testing agency:

1. For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.
2. For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.

Variations of the bearing plate size need not be considered.

The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.

4. Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.

**1913.2.8 Composite construction cores.** Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).

At least one core shall be taken from each building for each 5,000 square feet (465 m²) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

**1913.2.9 Tests of shotcrete.** Testing of shotcrete shall follow the provisions of Sections 1910, 1913.4, and the general requirements of ACI 318 Section 5.6.

**1913.2.10 Gypsum field tests.** Field tests shall be made during construction to verify gypsum strength. One sample consisting of three specimens shall be made for each 5,000 square feet (465 m²) or fraction thereof of all gypsum poured, but not less than one sample shall be taken from each half-day's pour.

**1913.2.11 Tests for post-installed anchors in concrete.** When post-installed anchors are used in lieu of cast-in-place bolts, the installation verification test loads frequency and acceptance criteria shall be in accordance with this section.

**1913.2.11.1 General.** Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

**1913.2.11.2 Test loads.** Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter ( $1\frac{1}{4}$ ) times the maximum design strength of anchors as provided in an approved test report using criteria adopted in this code or determined in accordance with Appendix D of ACI 318.

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ( $= 0.8 A_{se} f_{yu}$ ).

2. The manufacturer's recommended installation torque based on approved test report using criteria adopted in this code.

**1913.2.11.3 Test frequency.** When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

**Exceptions:**

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the factored design tension on anchors is less than 100 lb and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all the following conditions are met:
  - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
  - b. The number of dowels in any one member equals or exceeds 12.
  - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).
4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior nonshear wall partitions for shear only, where there are at least three fasteners per segment of track.

**1913.2.11.4 Test acceptance criteria.** Acceptance criteria for post-installed anchors shall be based on an approved test report using criteria adopted in this code or manufacturer's written instruction, acceptable to the enforcement agency. Field test shall satisfy following minimum requirements.

**1. Hydraulic ram method:**

Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discern-

ible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

For adhesive anchors, where other than bond is being tested, the testing device shall not restrict the concrete shear cone type failure mechanism from occurring.

**2. Torque wrench method:**

Anchors tested with a calibrated torque wrench must attain the specified torque within  $\frac{1}{2}$  turn of the nut.

**Exceptions:**

1. Wedge or sleeve type: One-quarter ( $\frac{1}{4}$ ) turn of the nut for a  $\frac{3}{8}$  in. sleeve anchor only.
2. Threaded type: One-quarter ( $\frac{1}{4}$ ) turn of the screw after initial seating of the screw head.

**1913.2.11.5 Testing procedure.** Test procedure shall be as permitted by approved test report using criteria adopted in this code. Torque controlled post-installed anchors shall be permitted to be tested using torque based on approved test report using criteria adopted in this code. All other post-installed anchors shall be tension tested. Manufacturer's recommendation for testing may be approved by the enforcement agency based on approved test report using criteria adopted in this code.

**1913.3 Modifications to ACI 318**

**1913.3.1 ACI 318, Section 5.6.2.1.** Replace ACI 318 Section 5.6.2.1 by the following:

5.6.2.1 - Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (38.2 m<sup>3</sup>) of concrete, or not less than once for each 2,000 square feet (186 m<sup>2</sup>) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

**1913.3.2 ACI 318, Section 14.9.** Modify ACI 318 by adding Section 14.9 as follows:

14.9 - Foundation walls. Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18

inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318 Section 14.3.

**1913.3.3 ACI 318, Section 21.9.2.2.** Modify ACI 318, Section 21.9.2.2 by adding the following:

Where boundary members are not required by ACI 318 Section 21.9.6, minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot of wall. Horizontal extent of boundary element shall be per ACI 318 Section 21.9.6.4 (a) and (b).

**1913.3.4 ACI 318, Section 21.9.4.** Modify ACI 318 by adding Section 21.9.4.6 as follows:

21.9.4.6 - Walls and portions of walls with  $P_u > 0.35P_o$  shall not be considered to contribute to the calculated strength of the structure for resisting earthquake-induced forces. Such walls shall conform to the requirements of ACI 318 Section 21.13.

**1913.3.5 ACI 318, Section 21.11.4.** Modify ACI 318 Section 21.11.4 by adding the following:

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or  $6d_b$  thick, where  $d_b$  is the diameter of the largest reinforcement in the topping slab.

**1913.3.6 ACI 318, Section 21.11.7.** Modify ACI 318 Section 21.11.7 by adding Section 21.11.7.7 as follows:

21.11.7.7 - Where boundary members are not required by ACI 318 Section 21.11.7.5, minimum reinforcement parallel to the edges of all diaphragms and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per linear foot of diaphragm.

**1913.3.7 ACI 318, Chapter 22.** Plain concrete is not permitted.

**1913.3.8 ACI 318, Section D.3.3.** Replace the requirements of Sections 1905.1.9 and 1905.1.10 with the following. Modify ACI 318, Sections D.3.3.4.2, D.3.3.4.3(d), and D.3.3.5.2 to read as follows:

D.3.3.4.2 - Where the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with Section D.3.3.4.3. The anchor design tensile strength shall be determined in accordance with Section D.3.3.4.4.

**Exception:**

Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 and Section 1604.8.2 of this code shall be deemed to satisfy Section D.3.3.4.3(d).

D.3.3.4.3(d) - The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E, with E increased by  $\Omega_e$ . The anchor design tensile strength shall be calculated from Section D.3.3.4.4.

D.3.3.5.2 - Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with Section D.3.3.5.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with Section D.6.

**Exceptions:**

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane design shear strength in accordance with Sections D.6.2 and D.6.3 need not be computed and Section D.3.3.5.3 shall be deemed to be satisfied, provided all of the following are met:

- 1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.
- 1.2. The maximum anchor nominal diameter is  $5/8$  inches (16 mm).
- 1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).
- 1.4. Anchor bolts are located a minimum of  $1\frac{3}{4}$  inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.
- 1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.
- 1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls the in-plane design shear strength in accordance with Sections D.6.2 and D.6.3 need not be computed and Section D.3.3.5.3 shall be deemed to be satisfied provided all of the following are met:

- 2.1. The maximum anchor nominal diameter is  $5/8$  inches (16 mm).
- 2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).



- 2.3. Anchors are located a minimum of  $1\frac{3}{4}$  inches (45 mm) from the edge of the concrete parallel to the length of the track.
- 2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.
- 2.5. The track is 33 to 68 mil designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100, Section E3.3.1.

3. In light-frame construction, bearing or non-bearing walls, shear strength of concrete anchors less than or equal to  $\frac{5}{8}$  inch (16 mm) in diameter of sill plate or track to foundation or foundation stem wall need not satisfy Section D.3.3.5.3 (a) through (c) when the design strength of the anchors is determined in accordance with Section D.6.2.1(c).

#### **1913.4 Shotcrete.**

**1913.4.1 Preconstruction tests.** A test panel prepared in accordance with Section 1913.5 is required. Approval from the enforcement agency must be obtained prior to performing test panels.

**1913.4.2 Surface preparation.** Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by sand blasting, and just prior to receiving shotcrete, shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be wetted before shotcrete is deposited, but not so wet as to overcome suction.

**1913.4.3 Joints.** The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

**1913.4.4 Forms and ground wires for shotcrete.** Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodged to these wires.

**1913.4.5 Placing.** Shotcrete shall be placed in accordance with ACI 506.

**1913.5 Existing concrete structures.** The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m<sup>2</sup>) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed  $\frac{3}{4}$  inch (19 mm).

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 19A – CONCRETE

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>							X		X			X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## CHAPTER 19A

# CONCRETE

*Italics are used for text within Sections 1903A through 1908A of this code to indicate provisions that differ from ACI 318. State of California amendments in these sections are shown in italics and underlined.*

### SECTION 1901A GENERAL

**1901A.1 Scope.** The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

**1901A.1.1 Application.** *The scope of application of Chapter 19A is as follows:*

- 1. Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
- 2. Applications listed in Sections 1.10.1, and 1.10.4, regulated by the Office of Statewide Health Planning and Development (OSHDP). These applications include hospitals, skilled nursing facilities, intermediate care facilities, and correctional treatment centers.*

**Exception:** *[OSHDP 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 19 and any applicable amendments therein.*

**1901A.1.2 Amendments in this chapter.** *DSA and OSHDP adopt this chapter and all amendments.*

**Exception:** *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

- 1. Division of the State Architect-Structural Safety:  
[DSA-SS] For applications listed in Section 1.9.2.1*
- 2. Office of Statewide Health Planning and Development.  
[OSHDP 1] – For applications listed in Section 1.10.1.  
[OSHDP 4] – For applications listed in Section 1.10.4.*

**1901A.2 Plain and reinforced concrete.** Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905A of this code. Except for the provisions of Sections 1904A and 1907A, the design and construction of slabs on grade shall not be governed by this chapter unless they trans-

mit vertical loads or lateral forces from other parts of the structure to the soil.

**1901A.3 Construction documents.** The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.
12. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

**1901A.4 Special inspection.** The special inspection of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17A.

### SECTION 1902A DEFINITIONS

**1902A.1 General.** The words and terms defined in ACI 318 shall, for the purposes of this chapter and as used elsewhere in this code for concrete construction, have the meanings shown in ACI 318 as modified by Section 1905A.1.1.

### SECTION 1903A SPECIFICATIONS FOR TESTS AND MATERIALS

**1903A.1 General.** Materials used to produce concrete, concrete itself and testing thereof shall comply with the applica-

ble standards listed in ACI 318. Where required, special inspections and tests shall be in accordance with Chapter 17A and Section 1913A.

**1903A.2 Glass fiber reinforced concrete.** Glass fiber reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL128 standard.

**1903A.3 Flat wall insulating concrete form (ICF) systems.** Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E 2634. [OSHPD 1 & 4] Not Permitted by OSHPD.

**1903A.4 Reporting requirements** – Modify ACI 318 Section 3.2.1 by adding the following:

Each component (a) through (g), when present, as a percentage of total cementitious materials shall be reported for each mix design.

**1903A.5 Fly ash** – Add ACI 318 Section 3.2.3 as follows:

Fly ash or other pozzolan can be used as a partial substitute for ASTM C 150 portland cement, as follows:

1. Fly ash or other pozzolan shall conform to ASTM C 618 for Class N or Class F materials (Class C is not permitted), and
2. More than 15 percent by weight of fly ash or other pozzolans shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 5.3. See Section 1904A for durability requirements.
3. More than 40 percent by weight of ground-granulated blast-furnace slag conforming to ASTM C 989 shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 5.3. See Section 1904A for durability requirements.

**1903A.6 Aggregates** – ACI 318 Section 3.3.2 Modify ACI 318 Section 3.3.2 by adding the following:

Aggregate size limitations waiver shall be approved by the enforcement agency.

Evidence that the aggregate used is not reactive in the presence of cement alkalis may be required by the enforcement agency. If new aggregate sources are to be used or if past experience indicates problems with existing aggregate sources, test the aggregate for potential alkali-silica reactivity in accordance with ASTM C 1260 or ASTM C 1293 to determine the potential alkali-silica reactivity of the aggregate. If the results indicate an expansion greater than 0.10 percent at 16-days age with ASTM C 1260, or an expansion greater than 0.04 percent at 12 months age with ASTM C 1293, provide mitigation with one of the cementitious material systems noted below such that an expansion of less than 0.10 percent at 16-days age is obtained with ASTM C 1567:

1. Low-alkali portland cement containing not more than 0.6 percent total alkali when calculated as sodium oxide, as determined by the method given in ASTM C 114.

2. Blended hydraulic cement, Type IS or IP, conforming to ASTM C 595, except that Type IS cement shall not contain less than 40 percent slag cement.

3. Replacement of not less than 15 percent by weight of the portland cement with a pozzolan conforming to ASTM C 618 for Class N or F materials (Class C is not permitted).

4. Replacement of not less than 40 percent by weight of the portland cement used by a ground granulated blast-furnace with slag cement conforming to ASTM C 989.

5. Replacement of not less than 5 percent nor more than 10 percent by weight of portland cement with silica fume conforming to ASTM C 1240.

6. Replacement of portland cement with a ternary blend of portland cement, slag cement and pozzolan such that the resulting blend contains not more than 70 percent portland cement

ASTM C 1567 shall be performed separately on the fine and coarse aggregate with one requiring the higher percentage of supplementary cementitious materials dictating the required replacement.

ASTM C 1260, ASTM C 1293 and ASTM C 1567 tests must have been performed within the past three years.

**1903A.7 Discontinuous steel fibers** – Modify ACI 318 Section 3.5.1 by adding the following:

Discontinuous steel fibers are not permitted.

**1903A.8 Welding of reinforcing bars** – Modify ACI 318 Section 3.5.2 by adding the following:

If mill test reports are not available, chemical analysis shall be made of bars representative of the bars to be welded. Bars with a carbon equivalent (C.E.) above 0.75 shall not be welded. Welding shall not be done on or within two bar diameters of any bent portion of a bar that has been bent cold. Welding of crossing bars shall not be permitted for assembly of reinforcement unless authorized by the structural engineer and approved by the enforcement agency per approved procedures.

## SECTION 1904A DURABILITY REQUIREMENTS

**1904A.1 Exposure categories and classes.** Concrete shall be assigned to exposure classes in accordance with the durability requirements of ACI 318 based on:

1. Exposure to freezing and thawing in a moist condition or deicer chemicals;
2. Exposure to sulfates in water or soil;
3. Exposure to water where the concrete is intended to have low permeability; and
4. Exposure to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater or spray from these sources, where the concrete has steel reinforcement.

**1904A.2 Concrete properties.** Concrete mixtures shall conform to the most restrictive maximum water-cementitious materials ratios, maximum cementitious admixtures, minimum air-entrainment and minimum specified concrete compressive strength requirements of ACI 318 based on the exposure classes assigned in Section 1904A.1.

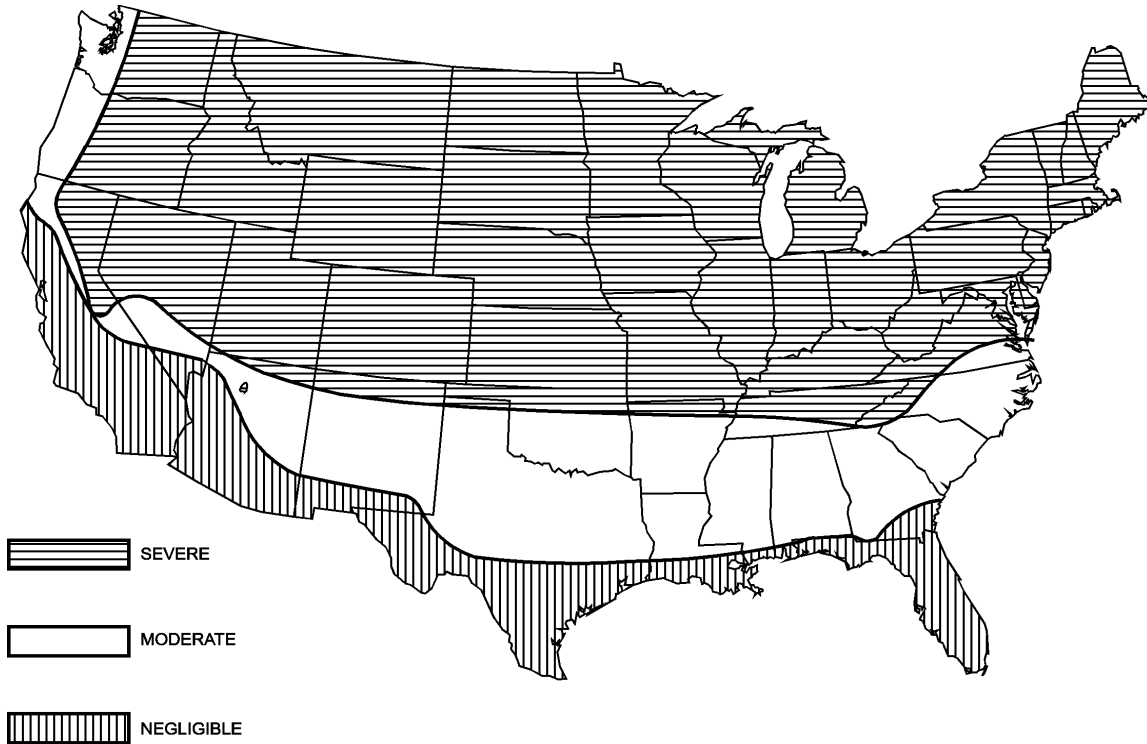
**Exception:** For occupancies and appurtenances thereto in Group R occupancies that are in buildings less than four stories above grade plane, normal-weight aggregate concrete is permitted to comply with the requirements of Table 1904A.2 based on the weathering classification (freezing and thawing) determined from Figure 1904A.2 in lieu of the durability requirements of ACI 318.

**TABLE 1904A.2**  
**MINIMUM SPECIFIED COMPRESSIVE STRENGTH ( $f'_c$ )**

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH ( $f'_c$ at 28 days, psi)		
	Negligible exposure	Moderate exposure	Severe exposure
Basement walls <sup>c</sup> and foundations not exposed to the weather	2,500	2,500	2,500 <sup>a</sup>
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 <sup>a</sup>
Basement walls <sup>c</sup> , foundation walls, exterior walls and other vertical concrete surfaces exposed to the weather	2,500	3,000 <sup>b</sup>	3,000 <sup>b</sup>
Driveways, curbs, walks, patios, porches, carport slabs, steps and other flatwork exposed to the weather, and garage floor slabs	2,500	3,000 <sup>b, d</sup>	3,500 <sup>b, d</sup>

For SI: 1 pound per square inch = 0.00689 MPa.

- a. Concrete in these locations that can be subjected to freezing and thawing during construction shall be of air-entrained concrete in accordance with Section 1904A.2.
- b. Concrete shall be air entrained in accordance with ACI 318.
- c. Structural plain concrete basement walls are exempt from the requirements for exposure conditions of Section 1904A.2.
- d. For garage floor slabs where a steel trowel finish is used, the total air content required by ACI 318 is permitted to be reduced to not less than 3 percent, provided the minimum specified compressive strength of the concrete is increased to 4,000 psi.



**FIGURE 1904A.2**  
**WEATHERING PROBABILITY MAP FOR CONCRETE<sup>a, b, c</sup>**

- a. Lines defining areas are approximate only. Local areas can be more or less severe than indicated by the region classification.
- b. A "severe" classification is where weather conditions encourage or require the use of deicing chemicals or where there is potential for a continuous presence of moisture during frequent cycles of freezing and thawing. A "moderate" classification is where weather conditions occasionally expose concrete in the presence of moisture to freezing and thawing, but where deicing chemicals are not generally used. A "negligible" classification is where weather conditions rarely expose concrete in the presence of moisture to freezing and thawing.
- c. Alaska and Hawaii are classified as severe and negligible, respectively.

## SECTION 1905A MODIFICATIONS TO ACI 318

**1905A.1 General.** The text of ACI 318 shall be modified as indicated in Sections 1905A.1.1 through 1905A.1.21.

**1905A.1.1 ACI 318, Section 5.1.1.** Modify ACI 318, Section 5.1.1, as follows:

For concrete designed and constructed in accordance with this chapter,  $f'_c$  shall not be less than 3,000 psi (20.7 MPa). Reinforced concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall require prior approval of structural design method and acceptance criteria by the enforcement agency.

**1905A.1.2 ACI 318, Section 5.6.2.1.** Replace ACI 318, Section 5.6.2.1, by the following:

5.6.2.1 Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (38.2 m<sup>3</sup>) of concrete, or not less than once for each 2,000 square feet (186 m<sup>2</sup>) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

**1905A.1.3 ACI 318, Section 8.13.5.** Replace ACI 318, Section 8.13.5, as follows:

8.13.5 – Permanent burned clay or concrete tile fillers shall be considered only as forms and shall not be included in the calculations involving shear or bending moments.

The thickness of the concrete slab on the permanent fillers shall be designed as described in ACI, Section 8.13.6, as modified in Section 1905A.1.4.

**1905A.1.4 ACI 318, Section 8.13.6.** Replace ACI 318, Section 8.13.6, as follows:

8.13.6 – Where removable forms or fillers are used, the thickness of the concrete slab shall not be less than  $\frac{1}{12}$  of the clear distance between joists and in no case less than  $2\frac{1}{2}$  inches (64 mm). Such slab shall be reinforced at right angles to the joists with at least the amount of reinforcement required for flexure, considering load concentrations, if any, but in no case shall the reinforcement be less than that required by ACI 318, Section 7.12.

**1905A.1.5 ACI 318, Section 8.13.** Add Section 8.13.9 to ACI 318 as follows:

8.13.9 Concrete bridging. Concrete bridging shall be provided as follows: one near the center of spans for 20 to 30 feet (6096 mm to 9144 mm) spans and two near the third points of spans over 30 feet (9144 mm). Such bridging shall be either:

(a) A continuous concrete web having a depth equal to the joist and a width not less than  $3\frac{1}{2}$  inches (89 mm) reinforced with a minimum of one No. 4 bar in the top and bottom; or

(b) Any other concrete element capable of transferring a concentrated load of 1,000 pounds (4.5 kN) from any joist to the two adjacent joists.

Such bridging shall not be required in roof framing if an individual member is capable of carrying dead load plus a concentrated load of 1,500 pounds (6.7 kN) at any point.

**1905A.1.6 ACI 318, Section 10.5.3.** Modify ACI 318, Section 10.5.3, by adding the following:

This section shall not be used for members that resist seismic loads, except that reinforcement provided for foundation elements for one-story wood-frame or one-story light steel buildings need not be more than one-third greater than that required by analysis for all loading conditions.

**1905A.1.7 ACI 318, Section 12.14.3.** Add Section 12.14.3.6 to ACI 318 as follows:

12.14.3.6 – Welded splices and mechanical connections shall maintain the clearance and coverage requirements of ACI 318, Sections 7.6 and 7.7.

**1905A.1.8 ACI 318, Section 14.2.6.** Replace ACI 318, Section 14.2.6, as follows:

14.2.6 – Walls shall be anchored to intersecting elements such as floors or roofs; or to columns, pilasters, buttresses, of intersecting walls and footings with reinforcement at least equivalent to No. 4 bars at 12 inches (305 mm) on center for each layer of reinforcement.

**1905A.1.9 ACI 318, Section 14.5 – Empirical design method.** Not permitted by DSA-SS.

**1905A.1.10 ACI 318, Section 14.9.** Modify ACI 318 by adding Section 14.9 as follows:

14.9 – Foundation walls. Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318, Section 14.3.

**1905A.1.11 ACI 318 Section 16.** Add Section 16.11 to ACI 318.1, as follows:

16.11 – Reinforcement. Perimeters of precast walls shall be reinforced continuously with a minimum of one No. 5 bar extending the full height and width of the wall panel. Bars shall be continuous around corners. Where wall panels do not abut columns or other wall panels,

perimeter bars shall be retained by hooked wall bars. Edges of openings in precast walls shall be reinforced with a minimum of one No. 5 bar continuous past corners sufficient to develop the bar.

A continuous tie or bond beam shall be provided at the roof line either as a part of the roof structure or part of the wall panels as described in the next paragraph below. This tie may be designed as the edge member of the roof diaphragm but, in any case, shall not be less than equivalent to two No. 6 bars continuous. A continuous tie equivalent to two No. 5 bars minimum shall also be provided either in the footing or with an enlarged section of the floor slab.

Wall panels of shear wall buildings shall be connected to columns or to each other in such a manner as to develop at least 75 percent of the horizontal wall steel. Half of this continuous horizontal reinforcing may be concentrated in bond or tie beams at the top and bottom of the walls and at points of intermediate lateral support. If possible, cast in-place joints with reinforcing bars extending from the panels into the joint a sufficient distance to meet the splice requirements of ACI 318, Section 12.15, for Class A shall be used. The reinforcing bars or welded tie details shall not be spaced over eight times the wall thickness vertically nor fewer than four used in the wall panel height. Where wall panels are designed for their respective overturning forces, the panel connections need not comply with the requirements of this paragraph.

Where splicing of reinforcement must be made at points of maximum stress or at closer spacing than permitted by ACI 318, Section 7.6, welding may be used when the entire procedure is suitable for the particular quality of steel used and the ambient conditions. Unless the welds develop 125 percent of the specified yield strength of the steel used, reinforcement in the form of continuous bars or fully anchored dowels shall be added to provide 25 percent excess steel area and the welds shall develop not less than the specified yield strength of the steel.

**Exception:** Nonbearing, nonshear panels such as nonstructural architectural cladding panels or column covers are not required to meet the provisions of this section.

**1905A.1.12 ACI 318, Section 17.5.1.** Modify ACI 318, Section 17.5.1, by adding Sections 17.5.1.1 and 17.5.1.2 as follows:

17.5.1.1 – Full transfer of horizontal shear forces may be assumed when all of the following are satisfied:

1. Contact surfaces are clean, free of laitance, and intentionally roughened to full amplitude of approximately  $\frac{1}{4}$  inch (6.4 mm).
2. Minimum ties are provided in accordance with ACI 318 Section 17.6.
3. Web members are designed to resist total vertical shear, and

4. All shear reinforcement is fully anchored into all interconnected elements.

17.5.1.2 - If any of the requirements of ACI 318, Section 17.5.1.1, is not satisfied, horizontal shear shall be investigated in accordance with ACI 318, Section 17.5.3 or 17.5.4.

**1905A.1.13 ACI 318, Section 18.2.3.** Modify ACI 318 Section 18.2.3 by adding the following:

For prestressed concrete members with recessed or dapped ends, an analysis of the connections shall be made in accordance with procedures given in PCI Design Handbook, 7<sup>th</sup> Edition.

**1905A.1.14 ACI 318 Section 18.2.4.** Modify ACI 318, Section 18.2.4, by adding the following:

Where prestressed concrete elements are restrained from movement, an analysis of the stresses in the prestressed elements and loads in the adjoining structural system induced by the above-described effects shall be made in accordance with PCI Design Handbook, 7<sup>th</sup> Edition.

**1905A.1.15 ACI 318, Section 18.2.** Add Section 18.2.7 to ACI 318 as follows:

18.2.7 – Span to depth ratio. Span to depth ratios for continuous prestressed concrete members shall not exceed the following, except when calculations of deflections prove that greater values may be used without adverse effects

Beams.....	30
One-way slabs.....	40
Two-way floor slabs.....	40
Two-way roof slabs.....	44

These ratios should be decreased for special conditions such as heavy loads and simple spans.

Maximum deflection criteria shall be in accordance with ACI 318 Section 9.5

**1905A.1.16.** (Chapter 19, Section 1905.1.3) **ACI 318, Section 21.4. [DSA-SS]** Modify ACI 318, Section 21.4, by modifying Section 21.4.2 and adding Section 21.4.2.1 as follows:

21.4.2 In connections between wall panels, yielding shall be restricted to steel elements or reinforcement. In connections between wall panels and the foundation, they shall be designed per Section 1616A.1.16.

21.4.2.1 – Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the deformation induced by the design displacement or shall use Type 2 mechanical splices.

**1905A.1.17 ACI 318, Section 21.9.2.2.** Modify ACI 318, Section 21.9.2.2 by adding the following:

Where boundary members are not required by ACI 318 Section 21.9.6, minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot



of wall. Horizontal extent of boundary element shall be per ACI 318 Section 21.9.6.4 (a) & (b).

**1905A.1.18 ACI 318, Section 21.9.4.** Modify ACI 318 by adding Section 21.9.4.6 as follows:

21.9.4.6 – Walls and portions of walls with  $P_u > 0.35P_o$  shall not be considered to contribute to the calculated strength of the structure for resisting earthquake-induced forces. Such walls shall conform to the requirements of ACI 318 Section 21.13.

**1905A.1.19 ACI 318, Section 21.11.4.** Modify ACI 318 Section 21.11.4 by adding the following:

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or  $6d_t$  thick, where  $d_t$  is the diameter of the largest reinforcement in the topping slab.

**1905A.1.20 ACI 318, Section 21.11.7.** Modify ACI 318 Section 21.11.7 by adding Section 21.11.7.7 as follows:

21.11.7.7 – Where boundary members are not required by ACI 318 Section 21.11.7.5, minimum reinforcement parallel to the edges of all diaphragms and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per linear foot of diaphragm.

**1905A.1.21 (Chapter 19, Section 1905.1.9) ACI 318, Section D.3.3.** Modify ACI 318, Sections D.3.3.4.2, D.3.3.4.3(d) and D.3.3.5.2, to read as follows:

D.3.3.4.2 – Where the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with Section D.3.3.4.3. The anchor design tensile strength shall be determined in accordance with Section D.3.3.4.4.

**Exception:**

Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7, Equation 12.11-1 or 12.14-10, and Section 1604A.8.2 of this code shall be deemed to satisfy Section D.3.3.4.3(d).

D.3.3.4.3(d) – The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E, with E increased by  $\Omega_e$ . The anchor design tensile strength shall be calculated from Section D.3.3.4.4.

D.3.3.5.2 – Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with Section D.3.3.5.3. The anchor design shear strength for

resisting earthquake forces shall be determined in accordance with Section D.6.

**Exceptions:**

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane design shear strength in accordance with Sections D.6.2 and D.6.3 need not be computed and Section D.3.3.5.3 shall be deemed to be satisfied, provided all of the following are met:

1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.

1.2. The maximum anchor nominal diameter is  $\frac{5}{8}$  inch (16 mm).

1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

1.4. Anchor bolts are located a minimum of  $1\frac{3}{4}$  inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls the in-plane design shear strength in accordance with Sections D.6.2 and D.6.3 need not be computed and Section D.3.3.5.3 shall be deemed to be satisfied, provided all of the following are met:

2.1. The maximum anchor nominal diameter is  $\frac{5}{8}$  inch (16 mm).

2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

2.3. Anchors are located a minimum of  $1\frac{3}{4}$  inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100, Section E3.3.1.

3. In light-frame construction, bearing or non-bearing walls, shear strength of concrete anchors less than or equal to  $\frac{5}{8}$  inch (16 mm) in diameter of sill plate or track to foundation or foundation stem wall need not satisfy Section D.3.3.5.3 (a) through (c) when the design strength of the anchors is determined in accordance with Section D.6.2.1(c).

## SECTION 1906A STRUCTURAL PLAIN CONCRETE

*Not permitted by OSHPD and DSA-SS*

## SECTION 1907A MINIMUM SLAB PROVISIONS

**1907A.1 General.** The thickness of concrete floor slabs supported directly on the ground shall not be less than  $3\frac{1}{2}$  inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

**Exception:** A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet ( $6.5 \text{ m}^2$ ) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork which will not be enclosed at a later date.
5. Where approved based on local site conditions.

## SECTION 1908A ANCHORAGE TO CONCRETE— ALLOWABLE STRESS DESIGN

**1908A.1 Scope.** The provisions of this section shall govern the allowable stress design of headed bolts and headed stud anchors cast in normal-weight concrete for purposes of transmitting structural loads from one connected element to the other. These provisions do not apply to anchors installed in hardened concrete or where load combinations include earth-

quake loads or effects. The bearing area of headed anchors shall be not less than one and one-half times the shank area. Where strength design is used, or where load combinations include earthquake loads or effects, the design strength of anchors shall be determined in accordance with Section 1909A. Bolts shall conform to ASTM A 307 or an approved equivalent.

**1908A.1.1 Power actuated fasteners.** Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of this section.

Power actuated fasteners shall be permitted in seismic shear for components exempt from permit requirements by Section 1616A.1.18 of this code and for interior nonbearing non-shear wall partitions. Power actuated fastener shall not be used to anchor exterior cladding or curtain wall systems.

**1908A.2 Allowable service load.** The allowable service load for headed anchors in shear or tension shall be as indicated in Table 1908A.2. Where anchors are subject to combined shear and tension, the following relationship shall be satisfied:

$$(P_s / P_t)^{5/3} + (V_s / V_t)^{5/3} \leq 1 \quad \text{(Equation 19A-1)}$$

where:

$P_s$  = Applied tension service load, pounds (N).

$P_t$  = Allowable tension service load from Table 1908A.2, pounds (N).

$V_s$  = Applied shear service load, pounds (N).

$V_t$  = Allowable shear service load from Table 1908A.2, pounds (N).

**1908A.3 Required edge distance and spacing.** The allowable service loads in tension and shear specified in Table 1908A.2 are for the edge distance and spacing specified. The edge distance and spacing are permitted to be reduced to 50 percent of the values specified with an equal reduction in allowable service load. Where edge distance and spacing are reduced less than 50 percent, the allowable service load shall be determined by linear interpolation.

**1908A.4 Increase in allowable load.** Increase of the values in Table 1908A.2 by one-third is permitted where the provisions of Section 1605A.3.2 permit an increase in allowable stress for wind loading.

**1908A.5 Increase for special inspection.** Where special inspection is provided for the installation of anchors, a 100-percent increase in the allowable tension values of Table 1908A.2 is permitted. No increase in shear value is permitted.

## SECTION 1909A ANCHORAGE TO CONCRETE— STRENGTH DESIGN

**1909A.1 Scope.** The provisions of this section shall govern the strength design of anchors installed in concrete for purposes of transmitting structural loads from one connected element to the other. Headed bolts, headed studs and hooked (J- or L-) bolts cast in concrete and expansion anchors and undercut anchors installed in hardened concrete shall be designed in accordance with Appendix D of ACI 318 as mod-

**TABLE 1908A.2**  
**ALLOWABLE SERVICE LOAD ON EMBEDDED BOLTS (pounds)**

BOLT DIAMETER (inches)	MINIMUM EMBEDMENT (inches)	EDGE DISTANCE (inches)	SPACING (inches)	MINIMUM CONCRETE STRENGTH (psi)					
				$f'_c = 2,500$		$f'_c = 3,000$		$f'_c = 4,000$	
				Tension	Shear	Tension	Shear	Tension	Shear
$1/4$	$2 1/2$	$1 1/2$	3	200	500	200	500	200	500
$3/8$	3	$2 1/4$	$4 1/2$	500	1,100	500	1,100	500	1,100
$1/2$	4	3	6	950	1,250	950	1,250	950	1,250
	4	5	6	1,450	1,600	1,500	1,650	1,550	1,750
$5/8$	$4 1/2$	$3 3/4$	$7 1/2$	1,500	2,750	1,500	2,750	1,500	2,750
	$4 1/2$	$6 1/4$	$7 1/2$	2,125	2,950	2,200	3,000	2,400	3,050
$3/4$	5	$4 1/2$	9	2,250	3,250	2,250	3,560	2,250	3,560
	5	$7 1/2$	9	2,825	4,275	2,950	4,300	3,200	4,400
$7/8$	6	$5 1/4$	$10 1/2$	2,550	3,700	2,550	4,050	2,550	4,050
1	7	6	12	3,050	4,125	3,250	4,500	3,650	5,300
$1 1/8$	8	$6 3/4$	$13 1/2$	3,400	4,750	3,400	4,750	3,400	4,750
$1 1/4$	9	$7 1/2$	15	4,000	5,800	4,000	5,800	4,000	5,800

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound = 4.45 N.

ified by Section 1905A.1.21, provided they are within the scope of Appendix D.

The strength design of anchors that are not within the scope of Appendix D of ACI 318, and as amended in Section 1905A.1.21, shall be in accordance with an approved procedure.

**1909A.1.1 Specialty inserts.** *Specialty inserts, including cast-in-place specialty inserts, tested in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section.*

## SECTION 1910A SHOTCRETE

**1910A.1 General.** Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for reinforced concrete and the provisions of ACI 506. *The specified compressive strength of shotcrete shall not be less than 3,000 psi (20.69 MPa).*

*Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by sand blasting, and just prior to receiving shotcrete, shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be wetted before shotcrete is deposited, but not so wet as to overcome suction. Sand for sand blasting shall be clean, sharp and uniform in size, with no particles that will pass a 50-mesh screen.*

**1910A.2 Proportions and materials.** Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in finished in-place hardened shotcrete meeting the strength requirements of this code.

**1910A.3 Aggregate.** Coarse aggregate, if used, shall not exceed  $3/4$  inch (19.1 mm).

*For shear walls, when total rebar in any direction is more than 0.31 in<sup>2</sup> / ft. or rebar size is larger than # 5, shotcrete shall conform to course aggregate grading No. 2 per Table 1.1 of ACI 506.*

**1910A.4 Reinforcement.** Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1913A.4.1 through 1913A.4.4.

**1910A.4.1 Size.** The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.

**1910A.4.2 Clearance.** When No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of  $2 1/2$  inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. When two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

**Exception:** Subject to the approval of the building official, required clearances shall be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.

**1910A.4.3 Splices.** Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of 2 inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted when approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.

**1910A.4.4 Spirally tied columns.** Shotcrete shall not be applied to spirally tied columns.

- **1910A.5 Preconstruction tests.** A test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The sample panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official.

**1910A.6 Rebound.** Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.

**1910A.7 Joints.** Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

*The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.*

**1910A.8 Damage.** In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

**1910A.9 Curing.** During the curing periods specified herein, shotcrete shall be maintained above 40°F (4°C) and in moist condition.

**1910A.9.1 Initial curing.** Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

**1910A.9.2 Final curing.** Final curing shall continue for seven days after shotcreting, or for three days if high-early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with an approved moisture-retaining cover.

**1910A.9.3 Natural curing.** Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent, and is authorized by the registered design professional and approved by the building official.

**1910A.10 Strength tests.** Strength tests for shotcrete shall be made in accordance with ASTM standards by an approved agency on specimens that are representative of the work and which have been water soaked for at least 24 hours prior to testing. When the maximum-size aggregate is larger than  $\frac{3}{8}$  inch (9.5 mm), specimens shall consist of not less than three 3-inch-diameter (76 mm) cores or 3-inch (76 mm) cubes. When the maximum-size aggregate is  $\frac{3}{8}$  inch (9.5 mm) or smaller, specimens shall consist of not less than 2-inch-diameter (51 mm) cores or 2-inch (51 mm) cubes.

**1910A.10.1 Sampling.** Specimens shall be taken from the in-place work or from test panels, and shall be taken at least once each shift, but not less than one for each 50 cubic yards (38.2 m<sup>3</sup>) of shotcrete.

**1910A.10.2 Panel criteria.** When the maximum-size aggregate is larger than  $\frac{3}{8}$  inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). When the maximum size aggregate is  $\frac{3}{8}$  inch (9.5 mm) or smaller, the test panels shall have minimum dimensions of 12 inches by 12 inches (305 mm by 305 mm). Panels shall be shot in the same position as the work, during the course of the work and by the nozzle-men doing the work. The conditions under which the panels are cured shall be the same as the work. *Approval from the enforcement agency shall be obtained prior to performing the test panel method.*

**1910A.11 Forms and ground wires for shotcrete.** Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.

*Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.*

**1910A.12 Placing.** Shotcrete shall be placed in accordance with ACI 506.

## SECTION 1911A REINFORCED GYPSUM CONCRETE

**1911A.1 General.** Reinforced gypsum concrete shall comply with the requirements of ASTM C 317 and ASTM C 956. *Reinforced gypsum concrete shall be considered as an alternative system.*

**1911A.2 Minimum thickness.** The minimum thickness of reinforced gypsum concrete shall be 2 inches (51 mm) except the minimum required thickness shall be reduced to 1½ inches (38 mm), provided the following conditions are satisfied:

1. The overall thickness, including the formboard, is not less than 2 inches (51 mm).
2. The clear span of the gypsum concrete between supports does not exceed 33 inches (838 mm).
3. Diaphragm action is not required.
4. The design live load does not exceed 40 pounds per square foot (psf) (1915A Pa).

## SECTION 1912A CONCRETE-FILLED PIPE COLUMNS

**1912A.1 General.** Concrete-filled pipe columns shall be manufactured from standard, extra-strong or double-extra-strong steel pipe or tubing that is filled with concrete so placed and manipulated as to secure maximum density and to ensure complete filling of the pipe without voids.

**1912A.2 Design.** The safe supporting capacity of concrete-filled pipe columns shall be computed in accordance with the approved rules or as determined by a test.

**1912A.3 Connections.** Caps, base plates and connections shall be of approved types and shall be positively attached to the shell and anchored to the concrete core. Welding of brackets without mechanical anchorage shall be prohibited. Where the pipe is slotted to accommodate webs of brackets or other connections, the integrity of the shell shall be restored by welding to ensure hooping action of the composite section.

**1912A.4 Reinforcement.** To increase the safe load-supporting capacity of concrete-filled pipe columns, the steel reinforcement shall be in the form of rods, structural shapes or pipe embedded in the concrete core with sufficient clearance to ensure the composite action of the section, but not nearer than 1 inch (25 mm) to the exterior steel shell. Structural shapes used as reinforcement shall be milled to ensure bearing on cap and base plates.

**1912A.5 Fire-resistance-rating protection.** Pipe columns shall be of such size or so protected as to develop the required fire-resistance ratings specified in Table 601. Where an outer steel shell is used to enclose the fire protective covering, the shell shall not be included in the calculations for strength of the column section. The minimum diameter of pipe columns shall be 4 inches (102 mm) except that in structures of Type V construction not exceeding three stories above grade plane or 40 feet (12 192 mm) in building height, pipe columns used in basements and as secondary steel members shall have a minimum diameter of 3 inches (76 mm).

**1912A.6 Approvals.** Details of column connections and splices shall be shop fabricated by approved methods and shall be approved only after tests in accordance with the approved rules. Shop-fabricated concrete-filled pipe columns shall be inspected by the building official or by an approved representative of the manufacturer at the plant.

## SECTION 1913A CONCRETE, REINFORCEMENT AND ANCHOR TESTING

**1913A.1 Cementitious material.** The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C 150 for portland cement and ASTM C 595 or ASTM C 1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C 618 or ASTM C 989, whichever is applicable. The concrete

producer shall provide copies of the cementitious material supplier's Certificate of Compliance that represents the materials used by date of shipment for concrete. Cementitious materials without Certification of Compliance shall not be used.

**1913A.2 Tests of reinforcing bars.** Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number and provided the mill analyses accompany the report, one tensile test and one bend test shall be made from a specimen from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2 1/2 tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings provided certified mill test reports are provided for each shipment of such reinforcement.

**1913A.3 Tests for prestressing steel and anchorage.** All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the jobsite. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or jobsite shall be furnished by the contractor and tested by an approved independent testing agency:

1. For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.
2. For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.

Variations of the bearing plate size need not be considered.

The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the pre-stressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.

4. Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.

**1913A.4 Composite construction cores.** Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).

At least one core shall be taken from each building for each 5,000 square feet (465m<sup>2</sup>) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

**1913A.5 Tests of shotcrete.** Testing of shotcrete shall follow the provisions of Section 1910A and the general requirements of ACI 318, Section 5.6.

**1913A.6 Gypsum field tests.** Field tests shall be made during construction to verify gypsum strength. One sample consisting of three specimens shall be made for each 5,000 square feet (465 m<sup>2</sup>) or fraction thereof of all gypsum poured, but not less than one sample shall be taken from each half day's pour.

**1913A.7 Tests for post-installed anchors in concrete.** When post-installed anchors are used in lieu of cast-in place bolts, the installation verification test loads, frequency, and acceptance criteria shall be in accordance with this section.

**1913A.7.1 General.** Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

**1913A.7.2 Test loads.** Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter ( $1\frac{1}{4}$ ) times the maximum design strength of anchors as provided in an approved test report using criteria adopted in this code or determined in accordance with Appendix D of ACI 318.

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ( $= 0.8 A_{se} f_{ya}$ ).

2. The manufacturer's recommended installation torque based on approved test report using criteria adopted in this code.

**1913A.7.3 Test frequency.** When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

#### Exceptions:

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the factored design tension on anchors is less than 100 lbs and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all of the following conditions are met:
  - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
  - b. The number of dowels in any one member equals or exceeds 12.
  - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).

4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.

**1913A.7.4 Test acceptance criteria.** Acceptance criteria for post-installed anchors shall be based on approved test report using criteria adopted in this code. Field test shall satisfy following minimum requirements.

1. Hydraulic ram method:

Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

For adhesive anchors, where other than bond is being tested, the testing device shall not restrict the

concrete shear cone type failure mechanism from occurring.

2. Torque wrench method:

Anchors tested with a calibrated torque wrench must attain the specified torque within  $\frac{1}{2}$  turn of the nut.

**Exceptions:**

a. Wedge or sleeve type:

One-quarter ( $\frac{1}{4}$ ) turn of the nut for a  $\frac{3}{8}$  in. sleeve anchor only.

b. Threaded type:

One-quarter ( $\frac{1}{4}$ ) turn of the screw after initial seating of the screw head.

Design capacities, reliability, serviceability of FRP materials shall be permitted to be established in accordance with ICC-ES AC 125. Minimum inspection requirements of FRP composite systems shall be in accordance with ICC-ES AC 178.

**1913A.7.5 Testing procedure.** Test procedure shall be as permitted by an approved test report using criteria adopted in this code. Torque controlled post-installed anchors shall be permitted to be tested using torque based on approved test report using criteria adopted in this code. All other post-installed anchors shall be tension tested. Manufacturer's recommendation for testing may be approved by the enforcement agency, based on an approved test report using criteria adopted in this code.

## SECTION 1914A EXISTING CONCRETE STRUCTURES

### 1914A.1. Existing concrete structures.

The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m<sup>2</sup>) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed  $\frac{3}{4}$  inch (19 mm).

**1914A.2 Crack repair by epoxy injection.** Crack repair of concrete and masonry member by epoxy injection, shall conform to all requirements of ACI 503.7.

**1914A.3 Concrete strengthening by externally bonded fiber reinforced polymer (FRP).** Design and construction of externally bonded FRP systems for strengthening concrete structures shall be in accordance with ACI 440.2R.

**Exceptions:**

1. Near-Surface Mounted (NSM) FRP bars shall not be permitted.
2. Strengthening of shear walls and diaphragms (including chords and collectors) shall be considered as an alternative system.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 20 – ALUMINUM

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X		X	X						X	X									
Adopt entire chapter as amended (amended sections listed below)							X	X	X			X								
Adopt only those sections that are listed below																				
Chapter / Section																				
2003							X	X	X			X								





## CHAPTER 20

# ALUMINUM

### SECTION 2001 GENERAL

**2001.1 Scope.** This chapter shall govern the quality, design, fabrication and erection of aluminum.

### SECTION 2002 MATERIALS

**2002.1 General.** Aluminum used for structural purposes in buildings and structures shall comply with AA ASM 35 and AA ADM 1. The nominal loads shall be the minimum design loads required by Chapter 16.

### SECTION 2003 INSPECTION

**2003.1 Inspection.** *[DSA-SS, DSA-SS/CC, OSHPD 1 & 4]*  
*Inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17A.*



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 21 – MASONRY

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X		X	X						X	X									
Adopt entire chapter as amended (amended sections listed below)								X												
Adopt only those sections that are listed below		X																		
Chapter / Section																				
2101.1.1								X												
2101.1.2								X												
2101.1.3								X												
2101.1.4								X												
2109.1.1																				
2113.9.2		X																		
2114.1								X												
2114.2								X												
2114.3								X												
2114.4								X												
2114.5								X												
2114.6.1								X												
> 2114.7								X												
2114.8								X												
2114.9.1								X												
> 2114.9.2.1								X												
2114.9.3								X												
2114.10								X												
2114.11.1								X												
> 2114.11.2								X												
2114.12								X												
2114.13								X												
2114.14								X												

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 21

# MASONRY

### SECTION 2101 GENERAL

**2101.1 Scope.** This chapter shall govern the materials, design, construction and quality of masonry.

#### **2101.1.1 Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC)**

*Community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC) as listed in Section 1.9.2.2.*

**2101.1.2 Amendments in this chapter.** DSA-SS/CC adopts this chapter and all amendments.

**Exception:** Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC) amendments appear in this chapter preceded with the appropriate acronym, as follows:

[DSA-SS/CC] – For community college buildings listed in Section 1.9.2.2.

**2101.1.3 Reference to other chapters.** [DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

**2101.1.4 Amendments.** [DSA-SS/CC] See Section 2114 for additional requirements.

**2101.2 Design methods.** Masonry shall comply with the provisions of one of the following design methods in this chapter as well as the requirements of Sections 2101 through 2104. Masonry designed by the allowable stress design provisions of Section 2101.2.1, the strength design provisions of Section 2101.2.2, the prestressed masonry provisions of Section 2101.2.3, or the direct design requirements of Section 2101.2.7 shall comply with Section 2105.

**2101.2.1 Allowable stress design.** Masonry designed by the allowable stress design method shall comply with the provisions of Sections 2106 and 2107.

**2101.2.2 Strength design.** Masonry designed by the strength design method shall comply with the provisions of Sections 2106 and 2108, except that autoclaved aerated concrete (AAC) masonry shall comply with the provisions of Section 2106 and Chapters 1 and 8 of TMS 402/ACI 530/ASCE 5.

**2101.2.3 Prestressed masonry.** Prestressed masonry shall be designed in accordance with Chapters 1 and 4 of TMS 402/ACI 530/ASCE 5 and Section 2106. Special inspection during construction shall be provided as set forth in Section 1705.4.

**2101.2.4 Empirical design.** Masonry designed by the empirical design method shall comply with the provisions of Sections 2106 and 2109 or Chapter 5 of TMS 402/ACI 530/ASCE 5.

**2101.2.5 Glass unit masonry.** Glass unit masonry shall comply with the provisions of Section 2110 or Chapter 7 of TMS 402/ACI 530/ASCE 5.

**2101.2.6 Masonry veneer.** Masonry veneer shall comply with the provisions of Chapter 14 or Chapter 6 of TMS 402/ACI 530/ASCE 5.

**2101.2.7 Direct design.** Masonry designed by the direct design method shall comply with the provisions of TMS 403.

**2101.3 Construction documents.** The construction documents shall show all of the items required by this code including the following:

1. Specified size, grade, type and location of reinforcement, anchors and wall ties.
2. Reinforcing bars to be welded and welding procedure.
3. Size and location of structural elements.
4. Provisions for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature and moisture.
5. Loads used in the design of masonry.
6. Specified compressive strength of masonry at stated ages or stages of construction for which masonry is designed, except where specifically exempted by this code.
7. Details of anchorage of masonry to structural members, frames and other construction, including the type, size and location of connectors.
8. Size and permitted location of conduits, pipes and sleeves.
9. The minimum level of testing and inspection as defined in Chapter 17, or an itemized testing and inspection program that meets or exceeds the requirements of Chapter 17.

**2101.3.1 Fireplace drawings.** The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

### SECTION 2102 DEFINITIONS AND NOTATIONS

**2102.1 General.** The following terms are defined in Chapter 2:

**AAC MASONRY.**

**ADOBE CONSTRUCTION.**

**Adobe, stabilized.**

**Adobe, unstabilized.**

## MASONRY

### ANCHOR.

### ARCHITECTURAL TERRA COTTA.

### AREA.

Gross cross-sectional.

Net cross-sectional.

### AUTOCLAVED AERATED CONCRETE (AAC).

### BED JOINT.

### BOND BEAM.

### BRICK.

Calcium silicate (sand lime brick).

Clay or shale.

Concrete.

### CAST STONE.

### CELL.

### CHIMNEY.

### CHIMNEY TYPES.

High-heat appliance type.

Low-heat appliance type.

Masonry type.

Medium-heat appliance type.

### CLEANOUT.

### COLLAR JOINT.

### COMPRESSIVE STRENGTH OF MASONRY.

### DIMENSIONS.

Nominal.

Specified.

### FIREPLACE.

### FIREPLACE THROAT.

### FOUNDATION PIER.

### HEAD JOINT.

### MASONRY.

Ashlar masonry.

Coursed ashlar.

Glass unit masonry.

Plain masonry.

Random ashlar.

Reinforced masonry.

Solid masonry.

Unreinforced (plain) masonry.

### MASONRY UNIT.

Hollow.

Solid.

### MORTAR.

### MORTAR, SURFACE-BONDING.

### PRESTRESSED MASONRY.

### PRISM.

### RUBBLE MASONRY.

Coursed rubble.

Random rubble.

Rough or ordinary rubble.

### RUNNING BOND.

### SHEAR WALL.

Detailed plain masonry shear wall.

Intermediate prestressed masonry shear wall.

Intermediate reinforced masonry shear wall.

Ordinary plain masonry shear wall.

Ordinary plain prestressed masonry shear wall.

Ordinary reinforced masonry shear wall.

Special prestressed masonry shear wall.

Special reinforced masonry shear wall.

### SPECIFIED.

SPECIFIED COMPRESSIVE STRENGTH OF  
MASONRY,  $f'_m$ .

### STACK BOND.

### STONE MASONRY.

Ashlar stone masonry.

Rubble stone masonry.

### STRENGTH.

Design strength.

Nominal strength.

Required strength.

### THIN-BED MORTAR.

### TIE, WALL.

### TILE, STRUCTURAL CLAY.

### WALL.

Cavity wall.

Composite wall.

Dry-stacked, surface-bonded wall.

Masonry-bonded hollow wall.

Parapet wall.

### WYTHER.

### NOTATIONS.

$d_b$  = Diameter of reinforcement, inches (mm).

$F_s$  = Allowable tensile or compressive stress in  
reinforcement, psi (MPa).

$f_r$  = Modulus of rupture, psi (MPa).

- $f'_{AAC}$  = Specified compressive strength of AAC masonry, the minimum compressive strength for a class of AAC masonry as specified in ASTM C 1386, psi (MPa).
- $f'_m$  = Specified compressive strength of masonry at age of 28 days, psi (MPa).
- $f'_{mi}$  = Specified compressive strength of masonry at the time of prestress transfer, psi (MPa).
- $K$  = The lesser of the masonry cover, clear spacing between adjacent reinforcement, or five times  $d_b$ , inches (mm).
- $L_s$  = Distance between supports, inches (mm).
- $l_d$  = Required development length or lap length of reinforcement, inches (mm).
- $P$  = The applied load at failure, pounds (N).
- $S_t$  = Thickness of the test specimen measured parallel to the direction of load, inches (mm).
- $S_w$  = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

## SECTION 2103 MASONRY CONSTRUCTION MATERIALS

**2103.1 Concrete masonry units.** Concrete masonry units shall conform to the following standards: ASTM C 55 for concrete brick; ASTM C 73 for calcium silicate face brick; ASTM C 90 for load-bearing concrete masonry units or ASTM C 744 for prefaced concrete and calcium silicate masonry units.

**2103.2 Clay or shale masonry units.** Clay or shale masonry units shall conform to the following standards: ASTM C 34 for structural clay load-bearing wall tile; ASTM C 56 for structural clay nonload-bearing wall tile; ASTM C 62 for building brick (solid masonry units made from clay or shale); ASTM C 1088 for solid units of thin veneer brick; ASTM C 126 for ceramic-glazed structural clay facing tile, facing brick and solid masonry units; ASTM C 212 for structural clay facing tile; ASTM C 216 for facing brick (solid masonry units made from clay or shale); ASTM C 652 for hollow brick (hollow masonry units made from clay or shale) or ASTM C 1405 for glazed brick (single-fired solid brick units).

**Exception:** Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E 119 or UL 263 and shall comply with the requirements of Table 602.

**2103.3 AAC masonry.** AAC masonry units shall conform to ASTM C 1386 for the strength class specified.

**2103.4 Stone masonry units.** Stone masonry units shall conform to the following standards: ASTM C 503 for marble building stone (exterior); ASTM C 568 for limestone building stone; ASTM C 615 for granite building stone; ASTM C 616 for sandstone building stone; or ASTM C 629 for slate building stone.

**2103.5 Architectural cast stone.** Architectural cast stone shall conform to ASTM C 1364.

**2103.6 Ceramic tile.** Ceramic tile shall be as defined in, and shall conform to the requirements of, ANSI A137.1.

**2103.7 Glass unit masonry.** Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of  $\frac{3}{16}$  inch (4.8 mm). Solid glass-block units shall be provided when required. The surfaces of units intended to be in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. Reclaimed units shall not be used.

**2103.8 Second-hand units.** Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

**2103.9 Mortar.** Mortar for use in masonry construction shall conform to ASTM C 270 and Articles 2.1 and 2.6 A of TMS 602/ACI 530.1/ASCE 6, except for mortars listed in Sections 2103.10, 2103.11 and 2103.12. Type S or N mortar conforming to ASTM C 270 shall be used for glass unit masonry.

**2103.10 Surface-bonding mortar.** Surface-bonding mortar shall comply with ASTM C 887. Surface bonding of concrete masonry units shall comply with ASTM C 946.

**2103.11 Mortars for ceramic wall and floor tile.** Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103.11.

TABLE 2103.11  
CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $\frac{1}{5}$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $\frac{1}{2}$ hydrated lime; 5 damp sand to 1 cement 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $\frac{1}{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $\frac{1}{2}$ hydrated lime; $2\frac{1}{2}$ dry sand or 3 damp sand

**2103.11.1 Dry-set Portland cement mortars.** Premixed prepared Portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

**2103.11.2 Latex-modified Portland cement mortar.** Latex-modified Portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in



latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

**2103.11.3 Epoxy mortar.** Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

**2103.11.4 Furan mortar and grout.** Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

**2103.11.5 Modified epoxy-emulsion mortar and grout.** Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

**2103.11.6 Organic adhesives.** Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall not be less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

**2103.11.7 Portland cement grouts.** Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

**2103.12 Mortar for AAC masonry.** Thin-bed mortar for AAC masonry shall comply with Article 2.1 C.1 of TMS 602/ACI 530.1/ASCE 6. Mortar used for the leveling courses of AAC masonry shall comply with Article 2.1 C.2 of TMS 602/ACI 530.1/ASCE 6.

**2103.13 Grout.** Grout shall comply with Article 2.2 of TMS 602/ACI 530.1/ASCE 6.

**2103.14 Metal reinforcement and accessories.** Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602/ACI 530.1/ASCE 6. Where unidentified reinforcement is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work.

## SECTION 2104 CONSTRUCTION

**2104.1 Masonry construction.** Masonry construction shall comply with the requirements of Sections 2104.1.1 through 2104.4 and with TMS 602/ACI 530.1/ASCE 6.

**2104.1.1 Tolerances.** Masonry, except masonry veneer, shall be constructed within the tolerances specified in TMS 602/ACI 530.1/ASCE 6.

**2104.1.2 Placing mortar and units.** Placement of mortar, grout, and clay, concrete, glass, and AAC masonry units shall comply with TMS 602/ACI 530.1/ASCE 6.

**2104.1.3 Installation of wall ties.** Wall ties shall be installed in accordance with TMS 602/ACI 530.1/ASCE 6.

**2104.1.4 Chases and recesses.** Chases and recesses shall be constructed as masonry units are laid. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on lintels.

**2104.1.5 Lintels.** The design for lintels shall be in accordance with the masonry design provisions of either Section 2107 or 2108.

**2104.1.6 Support on wood.** Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.12.

**2104.2 Corbeled masonry.** Corbeled masonry shall comply with the requirements of Section 1.12 of TMS 402/ACI 530/ASCE 5.

**2104.2.1 Molded cornices.** Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

**2104.3 Cold weather construction.** The cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 C, shall be implemented when the ambient temperature falls below 40°F (4°C).

**2104.4 Hot weather construction.** The hot weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 D, shall be implemented when the ambient air temperature exceeds 100°F (37.8°C), or 90°F (32.2°C) with a wind velocity greater than 8 mph (12.9 km/hr).

## SECTION 2105 QUALITY ASSURANCE

**2105.1 General.** A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17.

**2105.2 Acceptance relative to strength requirements.** Where required by Chapter 17, verification of the strength of masonry shall be in accordance with Sections 2105.2.1 and 2105.2.2.

**2105.2.1 Compliance with  $f'_m$  and  $f'_{AAC}$ .** Compressive strength of masonry shall be considered satisfactory if the compressive strength of each masonry wythe and grouted collar joint equals or exceeds the value of  $f'_m$  for clay and concrete masonry and  $f'_{AAC}$  for AAC masonry. For partially grouted clay and concrete masonry, the compressive strength of both the grouted and ungrouted masonry shall equal or exceed the applicable  $f'_m$ . At the time of prestress, the compressive strength of the masonry shall equal or exceed  $f'_{mi}$ , which shall be less than or equal to  $f'_m$ .

**2105.2.2 Determination of compressive strength.** The compressive strength for each wythe shall be determined

by the unit strength method or by the prism test method as specified herein.

**2105.2.2.1 Unit strength method.** The determination of compressive strength by the unit strength method shall be in accordance with Section 2105.2.2.1.1 for clay masonry, Section 2105.2.2.1.2 for concrete masonry and Section 2105.2.2.1.3 for AAC masonry.

**2105.2.2.1.1 Clay masonry.** The compressive strength of masonry shall be determined based on the strength of the units and the type of mortar specified using Table 2105.2.2.1.1, provided:

1. Units are sampled and tested to verify compliance with ASTM C 62, ASTM C 216 or ASTM C 652.
2. Thickness of bed joints does not exceed  $\frac{5}{8}$  inch (15.9 mm).
3. For grouted masonry, the grout meets one of the following requirements:

3.1. Grout conforms to Article 2.2 of TMS 602/ACI 530.1/ASCE 6.

3.2. Minimum grout compressive strength equals or exceeds  $f'_m$  but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

**TABLE 2105.2.2.1.1  
COMPRESSIVE STRENGTH OF CLAY MASONRY**

NET AREA COMPRESSIVE STRENGTH OF CLAY MASONRY UNITS (psi)		NET AREA COMPRESSIVE STRENGTH OF MASONRY (psi)
Type M or S mortar	Type N mortar	
1,700	2,100	1,000
3,350	4,150	1,500
4,950	6,200	2,000
6,600	8,250	2,500
8,250	10,300	3,000
9,900	—	3,500
11,500	—	4,000

For SI: 1 pound per square inch = 0.00689 MPa.

**2105.2.2.1.2 Concrete masonry.** The compressive strength of masonry shall be determined based on the strength of the unit and type of mortar specified using Table 2105.2.2.1.2, provided:

1. Units are sampled and tested to verify compliance with ASTM C 55 or ASTM C 90.
2. Thickness of bed joints does not exceed  $\frac{5}{8}$  inch (15.9 mm).
3. For grouted masonry, the grout meets one of the following requirements:

3.1. Grout conforms to Article 2.2 of TMS 602/ACI 530.1/ASCE 6.

3.2. Minimum grout compressive strength equals or exceeds  $f'_m$  but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

**TABLE 2105.2.2.1.2  
COMPRESSIVE STRENGTH OF CONCRETE MASONRY**

NET AREA COMPRESSIVE STRENGTH OF CONCRETE MASONRY UNITS (psi)		NET AREA COMPRESSIVE STRENGTH OF MASONRY (psi) <sup>a</sup>
Type M or S mortar	Type N mortar	
1,250	1,300	1,000
1,900	2,150	1,500
2,800	3,050	2,000
3,750	4,050	2,500
4,800	5,250	3,000

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

a. For units less than 4 inches in height, 85 percent of the values listed.

**2105.2.2.1.3 AAC masonry.** The compressive strength of AAC masonry shall be based on the strength of the AAC masonry unit only and the following shall be met:

1. Units conform to ASTM C 1386.
2. Thickness of bed joints does not exceed  $\frac{1}{8}$  inch (3.2 mm).
3. For grouted masonry, the grout meets one of the following requirements:

3.1. Grout conforms to Article 2.2 of TMS 602/ACI 530.1/ASCE 6.

3.2. Minimum grout compressive strength equals or exceeds  $f'_{AAC}$  but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

**2105.2.2.2 Prism test method.** The determination of compressive strength by the prism test method shall be in accordance with Sections 2105.2.2.2.1 and 2105.2.2.2.2.

**2105.2.2.2.1 General.** The compressive strength of clay and concrete masonry shall be determined by the prism test method:

1. Where specified in the construction documents.
2. Where masonry does not meet the requirements for application of the unit strength method in Section 2105.2.2.1.

**2105.2.2.2.2 Number of prisms per test.** A prism test shall consist of three prisms constructed and tested in accordance with ASTM C 1314.

**2105.3 Testing prisms from constructed masonry.** When approved by the building official, acceptance of masonry that does not meet the requirements of Section 2105.2.2.1 or 2105.2.2.2 shall be permitted to be based on tests of prisms cut from the masonry construction in accordance with Sections 2105.3.1, 2105.3.2 and 2105.3.3.

**2105.3.1 Prism sampling and removal.** A set of three masonry prisms that are at least 28 days old shall be saw cut from the masonry for each 5,000 square feet (465 m<sup>2</sup>) of the wall area that is in question but not less than one set of three masonry prisms for the project. The length, width and height dimensions of the prisms shall comply with the requirements of ASTM C 1314. Transporting, preparation and testing of prisms shall be in accordance with ASTM C 1314.

**2105.3.2 Compressive strength calculations.** The compressive strength of prisms shall be the value calculated in accordance ASTM C 1314, except that the net cross-sectional area of the prism shall be based on the net mortar bedded area.

**2105.3.3 Compliance.** Compliance with the requirement for the specified compressive strength of masonry,  $f'_m$ , shall be considered satisfied provided the modified compressive strength equals or exceeds the specified  $f'_m$ . Additional testing of specimens cut from locations in question shall be permitted.

## SECTION 2106 SEISMIC DESIGN

**2106.1 Seismic design requirements for masonry.** Masonry structures and components shall comply with the requirements in Section 1.18 of TMS 402/ACI 530/ASCE 5 depending on the structure's seismic design category.

## SECTION 2107 ALLOWABLE STRESS DESIGN

**2107.1 General.** The design of masonry structures using allowable stress design shall comply with Section 2106 and the requirements of Chapters 1 and 2 of TMS 402/ACI 530/ASCE 5 except as modified by Sections 2107.2 through 2107.4.

**2107.2 TMS 402/ACI 530/ASCE 5, Section 2.1.8.7.1.1, lap splices.** In lieu of Section 2.1.8.7.1.1, it shall be permitted to design lap splices in accordance with Section 2107.2.1.

**2107.2.1 Lap splices.** The minimum length of lap splices for reinforcing bars in tension or compression,  $l_d$ , shall be

$$l_d = 0.002d_b f_s \quad \text{(Equation 21-1)}$$

For SI:  $l_d = 0.29d_b f_s$

but not less than 12 inches (305 mm). In no case shall the length of the lapped splice be less than 40 bar diameters.

where:

$d_b$  = Diameter of reinforcement, inches (mm).

$f_s$  = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress,  $F_s$ , the lap length of splices shall be increased not less than 50 percent of the minimum required length. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

**2107.3 TMS 402/ACI 530/ASCE 5, Section 2.1.8.7, splices of reinforcement.** Modify Section 2.1.8.7 as follows:

2.1.8.7 Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. All welding shall conform to AWS D1.4. Welded splices shall be of ASTM A 706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section 2.1.8.7.3.

**2107.4 TMS 402/ACI 530/ASCE 5, Section 2.3.7, maximum bar size.** Add the following to Chapter 2:

2.3.7 Maximum bar size. The bar diameter shall not exceed one-eighth of the nominal wall thickness and shall not exceed one-quarter of the least dimension of the cell, course or collar joint in which it is placed.

## SECTION 2108 STRENGTH DESIGN OF MASONRY

**2108.1 General.** The design of masonry structures using strength design shall comply with Section 2106 and the requirements of Chapters 1 and 3 of TMS 402/ACI 530/ASCE 5, except as modified by Sections 2108.2 through 2108.3.

**Exception:** AAC masonry shall comply with the requirements of Chapters 1 and 8 of TMS 402/ACI 530/ASCE 5.

**2108.2 TMS 402/ACI 530/ASCE 5, Section 3.3.3.3 development.** Modify the second paragraph of Section 3.3.3.3 as follows:

The required development length of reinforcement shall be determined by Equation (3-16), but shall not be less than 12 inches (305 mm) and need not be greater than  $72 d_b$ .

**2108.3 TMS 402/ACI 530/ASCE 5, Section 3.3.3.4, splices.** Modify items (c) and (d) of Section 3.3.3.4 as follows:

3.3.3.4 (c). A welded splice shall have the bars butted and welded to develop at least 125 percent of the yield strength,  $f_y$ , of the bar in tension or compression, as required. Welded splices shall be of ASTM A 706 steel reinforcement. Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls or special moment frames of masonry.

3.3.3.4 (d). Mechanical splices shall be classified as Type 1 or 2 according to Section 21.2.6.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls or special moment frames. Type 2 mechanical splices are permitted in any location within a member.

## SECTION 2109 EMPIRICAL DESIGN OF MASONRY

**2109.1 General.** Empirically designed masonry shall conform to the requirements of Chapter 5 of TMS 402/ACI 530/ASCE 5, except where otherwise noted in this section.

**2109.1.1 Limitations.** The use of empirical design of masonry shall be limited as noted in Section 5.1.2 of TMS 402/ACI 530/ASCE 5. The use of dry-stacked, surface-bonded masonry shall be prohibited in Risk Category IV structures. In buildings that exceed one or more of the limitations of Section 5.1.2 of TMS 402/ACI 530/ASCE 5, masonry shall be designed in accordance with the engineered design provisions of Section 2101.2.1, 2101.2.2 or 2101.2.3 or the foundation wall provisions of Section 1807.1.5.

Section 5.1.2.2 of TMS 402/ACI 530/ASCE 5 shall be modified as follows:

**5.1.2.2 Wind –** Empirical requirements shall not apply to the design or construction of masonry for buildings, parts of buildings, or other structures to be located in areas where  $V_{asd}$  as determined in accordance with Section 1609.3.1 of the *California Building Code* exceeds 110 mph.

**2109.2 Surface-bonded walls.** Dry-stacked, surface-bonded concrete masonry walls shall comply with the requirements of Chapter 5 of TMS 402/ACI 530/ASCE 5, except where otherwise noted in this section.

**2109.2.1 Strength.** Dry-stacked, surface-bonded concrete masonry walls shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2109.2.1. Allowable stresses not specified in Table 2109.2.1 shall comply with the requirements of TMS 402/ACI 530/ASCE 5.

**TABLE 2109.2.1  
ALLOWABLE STRESS GROSS CROSS-SECTIONAL  
AREA FOR DRY-STACKED, SURFACE-BONDED  
CONCRETE MASONRY WALLS**

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression standard block	45
Flexural tension	
Horizontal span	30
Vertical span	18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

**2109.2.2 Construction.** Construction of dry-stacked, surface-bonded masonry walls, including stacking and leveling of units, mixing and application of mortar and curing and protection shall comply with ASTM C 946.

**2109.3 Adobe construction.** Adobe construction shall comply with this section and shall be subject to the requirements of this code for Type V construction, Chapter 5 of TMS 402/ACI 530/ASCE 5, and this section.

**2109.3.1 Unstabilized adobe.** Unstabilized adobe shall comply with Sections 2109.3.1.1 through 2109.3.1.4.

**2109.3.1.1 Compressive strength.** Adobe units shall have an average compressive strength of 300 psi (2068 kPa) when tested in accordance with ASTM C 67. Five samples shall be tested and no individual unit is permitted to have a compressive strength of less than 250 psi (1724 kPa).

**2109.3.1.2 Modulus of rupture.** Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and no individual unit shall have a modulus of rupture of less than 35 psi (241 kPa).

**2109.3.1.2.1 Support conditions.** A cured unit shall be simply supported by 2-inch-diameter (51 mm) cylindrical supports located 2 inches (51 mm) in from each end and extending the full width of the unit.

**2109.3.1.2.2 Loading conditions.** A 2-inch-diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

**2109.3.1.2.3 Testing procedure.** A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

**2109.3.1.2.4 Modulus of rupture determination.** The modulus of rupture shall be determined by the equation:

$$f_r = 3 PL_s / 2 S_w (S_t^2) \quad (\text{Equation 21-2})$$

where, for the purposes of this section only:

$S_w$  = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

$f_r$  = Modulus of rupture, psi (MPa).

$L_s$  = Distance between supports, inches (mm).

$S_t$  = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

$P$  = The applied load at failure, pounds (N).

**2109.3.1.3 Moisture content requirements.** Adobe units shall have a moisture content not exceeding 4 percent by weight.

**2109.3.1.4 Shrinkage cracks.** Adobe units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76 mm) in length or  $1/8$  inch (3.2 mm) in width.

**2109.3.2 Stabilized adobe.** Stabilized adobe shall comply with Section 2109.3.1 for unstabilized adobe in addition to Sections 2109.3.2.1 and 2109.3.2.2.

**2109.3.2.1 Soil requirements.** Soil used for stabilized adobe units shall be chemically compatible with the stabilizing material.

**2109.3.2.2 Absorption requirements.** A 4-inch (102 mm) cube, cut from a stabilized adobe unit dried to a constant weight in a ventilated oven at 212°F to 239°F (100°C to 115°C), shall not absorb more than  $2\frac{1}{2}$  percent moisture by weight when placed upon a constantly water-saturated, porous surface for seven days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

**2109.3.3 Allowable stress.** The allowable compressive stress based on gross cross-sectional area of adobe shall not exceed 30 psi (207 kPa).

**2109.3.3.1 Bolts.** Bolt values shall not exceed those set forth in Table 2109.3.3.1.

**TABLE 2109.3.3.1  
ALLOWABLE SHEAR ON BOLTS IN ADOBE MASONRY**

DIAMETER OF BOLTS (inches)	MINIMUM EMBEDMENT (inches)	SHEAR (pounds)
$\frac{1}{2}$	—	—
$\frac{5}{8}$	12	200
$\frac{3}{4}$	15	300
$\frac{7}{8}$	18	400
1	21	500
$1\frac{1}{8}$	24	600

For SI: 1 inch = 25.4 mm, 1 pound = 4.448 N.

**2109.3.4 Detailed requirements.** Adobe construction shall comply with Sections 2109.3.4.1 through 2109.3.4.9.

**2109.3.4.1 Number of stories.** Adobe construction shall be limited to buildings not exceeding one story, except that two-story construction is allowed when designed by a registered design professional.

**2109.3.4.2 Mortar.** Mortar for adobe construction shall comply with Sections 2109.3.4.2.1 and 2109.3.4.2.2.

**2109.3.4.2.1 General.** Mortar for stabilized adobe units shall comply with Chapter 21 or adobe soil. Adobe soil used as mortar shall comply with material requirements for stabilized adobe. Mortar for unstabilized adobe shall be Portland cement mortar.

**2109.3.4.2.2 Mortar joints.** Adobe units shall be laid with full head and bed joints and in full running bond.

**2109.3.4.3 Parapet walls.** Parapet walls constructed of adobe units shall be waterproofed.

**2109.3.4.4 Wall thickness.** The minimum thickness of exterior walls in one-story buildings shall be 10 inches (254 mm). The walls shall be laterally supported at intervals not exceeding 24 feet (7315 mm). The minimum thickness of interior load-bearing walls shall be 8 inches (203 mm). In no case shall the unsupported height of any wall constructed of adobe units exceed 10 times the thickness of such wall.

**2109.3.4.5 Foundations.** Foundations for adobe construction shall be in accordance with Sections 2109.3.4.5.1 and 2109.3.4.5.2.

**2109.3.4.5.1 Foundation support.** Walls and partitions constructed of adobe units shall be supported by foundations or footings that extend not less than 6 inches (152 mm) above adjacent ground surfaces and are constructed of solid masonry (excluding adobe) or concrete. Footings and foundations shall comply with Chapter 18.

**2109.3.4.5.2 Lower course requirements.** Stabilized adobe units shall be used in adobe walls for the first 4 inches (102 mm) above the finished first-floor elevation.

**2109.3.4.6 Isolated piers or columns.** Adobe units shall not be used for isolated piers or columns in a load-bearing capacity. Walls less than 24 inches (610 mm) in length shall be considered isolated piers or columns.

**2109.3.4.7 Tie beams.** Exterior walls and interior load-bearing walls constructed of adobe units shall have a continuous tie beam at the level of the floor or roof bearing and meeting the following requirements.

**2109.3.4.7.1 Concrete tie beams.** Concrete tie beams shall be a minimum depth of 6 inches (152 mm) and a minimum width of 10 inches (254 mm). Concrete tie beams shall be continuously reinforced with a minimum of two No. 4 reinforcing bars. The specified compressive strength of concrete shall be at least 2,500 psi (17.2 MPa).

**2109.3.4.7.2 Wood tie beams.** Wood tie beams shall be solid or built up of lumber having a minimum nominal thickness of 1 inch (25 mm), and shall have a minimum depth of 6 inches (152 mm) and a minimum width of 10 inches (254 mm). Joints in wood tie beams shall be spliced a minimum of 6 inches (152 mm). No splices shall be allowed within 12 inches (305 mm) of an opening. Wood used in tie beams shall be approved naturally decay-resistant or preservative-treated wood.

**2109.3.4.8 Exterior finish.** Exterior walls constructed of unstabilized adobe units shall have their exterior surface covered with a minimum of two coats of Portland cement plaster having a minimum thickness of  $\frac{3}{4}$  inch (19.1 mm) and conforming to ASTM C 926. Lathing shall comply with ASTM C 1063. Fasteners shall be spaced at 16 inches (406 mm) o.c. maximum. Exposed wood surfaces shall be treated with an approved wood preservative or other protective coating prior to lath application.

**2109.3.4.9 Lintels.** Lintels shall be considered structural members and shall be designed in accordance with the applicable provisions of Chapter 16.

## SECTION 2110 GLASS UNIT MASONRY

**2110.1 General.** Glass unit masonry construction shall comply with Chapter 7 of TMS 402/ACI 530/ASCE 5 and this section.

**2110.1.1 Limitations.** Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers, fire partitions or smoke barriers, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

### Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than  $\frac{3}{4}$  hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways, exit ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404.6, Exception 2.

## SECTION 2111 MASONRY FIREPLACES

**2111.1 Definition.** A masonry fireplace is a fireplace constructed of concrete or masonry. Masonry fireplaces shall be constructed in accordance with this section.

**2111.2 Footings and foundations.** Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

**2111.2.1 Ash dump cleanout.** Cleanout openings, located within foundation walls below fireboxes, when provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

**2111.3 Seismic reinforcing.** In structures assigned to *Seismic Design Category A or B*, reinforcement and seismic anchorage are not required. Masonry or concrete fireplaces shall be constructed, anchored, supported and reinforced as required in this chapter. In structures assigned to *Seismic Design Category C or D*, masonry and concrete fireplaces shall be reinforced and anchored as detailed in Sections 2111.3.1, 2111.3.2, 2111.4 and 2111.4.1 for chimneys serving fireplaces. In structures assigned to *Seismic Design Category E or F*, masonry and concrete chimneys shall be reinforced in

accordance with the requirements of Sections 2101 through 2108.

**2111.3.1 Vertical reinforcing.** For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.12. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

**2111.3.2 Horizontal reinforcing.** Vertical reinforcement shall be placed enclosed within  $\frac{1}{4}$ -inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at a minimum of every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

**2111.4 Seismic anchorage.** Masonry and concrete chimneys in structures assigned to *Seismic Design Category C or D* shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the following requirements.

**2111.4.1 Anchorage.** Two  $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25.4 mm) straps shall be embedded a minimum of 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to a minimum of four floor joists with two  $\frac{1}{2}$ -inch (12.7 mm) bolts.

**2111.5 Firebox walls.** Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. When a lining of firebrick at least 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and sidewalls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall not be greater than  $\frac{1}{4}$  inch (6.4 mm). When no lining is provided, the total minimum thickness of back and sidewalls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C 27 or ASTM C 1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C 199.

**2111.5.1 Steel fireplace units.** Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than  $\frac{1}{4}$  inch (6.4 mm) in thickness, and an air-circulating chamber which is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

**2111.6 Firebox dimensions.** The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall not be less than 8 inches (203 mm) above the fireplace opening. The throat opening shall not be less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall not be less than the cross-sectional area of the flue.

**Exception:** Rumford fireplaces shall be permitted provided that the depth of the fireplace is at least 12 inches (305 mm) and at least one-third of the width of the fireplace opening, and the throat is at least 12 inches (305 mm) above the lintel, and at least  $\frac{1}{20}$  the cross-sectional area of the fireplace opening.

**2111.7 Lintel and throat.** Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located a minimum of 8 inches (203 mm) above the top of the fireplace opening.

**2111.7.1 Damper.** Masonry fireplaces shall be equipped with a ferrous metal damper located at least 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

**2111.8 Smoke chamber walls.** Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C 199. When a lining of firebrick at least 2 inches (51 mm) thick, or a lining of vitrified clay at least  $\frac{5}{8}$  inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C 1261 and shall be laid with refractory mortar conforming to ASTM C 199. Vitrified clay linings shall conform to ASTM C 315.

**2111.8.1 Smoke chamber dimensions.** The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical when prefabricated smoke chamber linings are used or when the smoke chamber walls are rolled or sloped rather than corbeled. When the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

**2111.9 Hearth and hearth extension.** Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. No combustible material shall remain against the underside of hearths or hearth extensions after construction.

**2111.9.1 Hearth thickness.** The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

**2111.9.2 Hearth extension thickness.** The minimum thickness of hearth extensions shall be 2 inches (51 mm).

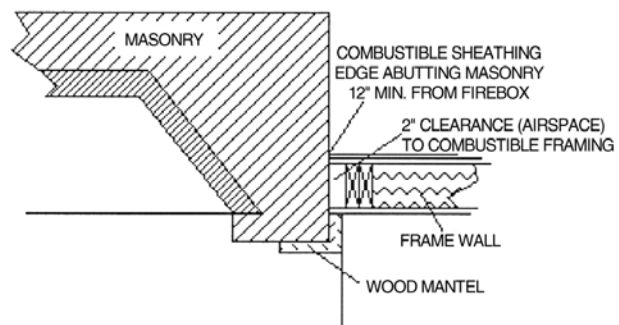
**Exception:** When the bottom of the firebox opening is raised at least 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than  $\frac{3}{8}$ -inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

**2111.10 Hearth extension dimensions.** Hearth extensions shall extend at least 16 inches (406 mm) in front of, and at least 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m<sup>2</sup>) or larger, the hearth extension shall extend at least 20 inches (508 mm) in front of, and at least 12 inches (305 mm) beyond, each side of the fireplace opening.

**2111.11 Fireplace clearance.** Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section 2111.12.

#### Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and dry-wall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with



For SI: 1 inch = 25.4 mm

**FIGURE 2111.11**  
**ILLUSTRATION OF EXCEPTION TO**  
**FIREPLACE CLEARANCE PROVISION**

Figure 2111.11, provided such combustible trim or sheathing is a minimum of 12 inches (306 mm) from the inside surface of the nearest firebox lining.

4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than  $\frac{1}{8}$  inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than  $1\frac{1}{2}$  inches (38 mm) from the face of the fireplace shall have an additional clearance equal to the projection.

**2111.12 Fireplace fireblocking.** All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

**2111.13 Exterior air.** Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

**2111.13.1 Factory-built fireplaces.** Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

**2111.13.2 Masonry fireplaces.** Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

**2111.13.3 Exterior air intake.** The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within a garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of  $\frac{1}{4}$ -inch (6.4 mm) mesh.

**2111.13.4 Clearance.** Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

**2111.13.5 Passageway.** The combustion air passageway shall be a minimum of 6 square inches (3870 mm<sup>2</sup>) and not more than 55 square inches (0.035 m<sup>2</sup>), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

**2111.13.6 Outlet.** The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to

prevent burning material from dropping into concealed combustible spaces.

## SECTION 2112 MASONRY HEATERS

**2112.1 Definition.** A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as "masonry," which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox may include flow in a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.

**2112.2 Installation.** Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E 1602; or
2. Masonry heaters shall be listed and labeled in accordance with UL 1482 and installed in accordance with the manufacturer's installation instructions.

**2112.3 Footings and foundation.** The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113.2.

**2112.4 Seismic reinforcing.** In structures assigned to Seismic Design Category D, E or F, masonry heaters shall be anchored to the masonry foundation in accordance with Section 2113.3. Seismic reinforcing shall not be required within the body of a masonry heater with a height that is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section 2113.

**2112.5 Masonry heater clearance.** Combustible materials shall not be placed within 36 inches (765 mm) of the outside surface of a masonry heater in accordance with NFPA 211, Section 8-7 (clearances for solid fuel-burning appliances), and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

### Exceptions:

1. When the masonry heater wall thickness is at least 8 inches (203 mm) thick of solid masonry and the wall thickness of the heat exchange channels is at least 5 inches (127 mm) thick of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of at least 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 and installed in accordance with the manufacturer's instructions.



## SECTION 2113 MASONRY CHIMNEYS

**2113.1 Definition.** A masonry chimney is a chimney constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete, hereinafter referred to as “masonry.” Masonry chimneys shall be constructed, anchored, supported and reinforced as required in this chapter.

**2113.2 Footings and foundations.** Footings for masonry chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

**2113.3 Seismic reinforcing.** Masonry or concrete chimneys shall be constructed, anchored, supported and reinforced as required in this chapter. In structures assigned to Seismic Design Category C or D, masonry and concrete chimneys shall be reinforced and anchored as detailed in Sections 2113.3.1, 2113.3.2 and 2113.4. In structures assigned to Seismic Design Category A or B, reinforcement and seismic anchorage is not required. In structures assigned to Seismic Design Category E or F, masonry and concrete chimneys shall be reinforced in accordance with the requirements of Sections 2101 through 2108.

**2113.3.1 Vertical reinforcing.** For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.12. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

**2113.3.2 Horizontal reinforcing.** Vertical reinforcement shall be placed enclosed within  $\frac{1}{4}$ -inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) o.c. in concrete, or placed in the bed joints of unit masonry, at a minimum of every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

**2113.4 Seismic anchorage.** Masonry and concrete chimneys and foundations in structures assigned to Seismic Design Category C or D shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the following requirements.

**2113.4.1 Anchorage.** Two  $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25 mm) straps shall be embedded a minimum of 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to a minimum of four floor joists with two  $\frac{1}{2}$ -inch (12.7 mm) bolts.

**2113.5 Corbeling.** Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

**2113.6 Changes in dimension.** The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

**2113.7 Offsets.** Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113.5.

**2113.8 Additional load.** Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

**2113.9 Termination.** Chimneys shall extend at least 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall not be less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

**2113.9.1 Chimney caps.** Masonry chimneys shall have a concrete, metal or stone cap, sloped to shed water, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C 1283.

**2113.9.2 Spark arrestors.** *[SFM] All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester. The spark arrester shall meet all of the following requirements:*

1. *The net free area of the arrester shall not be less than four times the net free area of the outlet of the chimney flue it serves.*
2. *The arrester screen shall have heat and corrosion resistance equivalent to 12-gage wire, 19-gage galvanized steel or 24-gage stainless steel.*
3. *Openings shall not permit the passage of spheres having a diameter greater than  $\frac{1}{2}$  inch (13 mm) nor block the passage of spheres having a diameter less than  $\frac{3}{8}$  inch (11 mm).*
4. *The spark arrester shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.*

**2113.9.3 Rain caps.** Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall not be less than four times the net free area of the outlet of the chimney flue it serves.

**2113.10 Wall thickness.** Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

**2113.10.1 Masonry veneer chimneys.** Where masonry is used as veneer for a framed chimney, through flashing and weep holes shall be provided as required by Chapter 14.

**2113.11 Flue lining (material).** Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

**2113.11.1 Residential-type appliances (general).** Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C 315.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

**2113.11.1.1 Flue linings for specific appliances.** Flue linings other than those covered in Section 2113.11.1 intended for use with specific appliances shall comply with Sections 2113.11.1.2 through 2113.11.1.4 and Sections 2113.11.2 and 2113.11.3.

**2113.11.1.2 Gas appliances.** Flue lining systems for gas appliances shall be in accordance with the *California Mechanical Code*.

**2113.11.1.3 Pellet fuel-burning appliances.** Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113.11.1.5 for marking).

**2113.11.1.4 Oil-fired appliances approved for use with L-vent.** Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with Section 2113.11.1 and listed chimney liners complying with UL 641 (see Section 2113.11.1.5 for marking).

**2113.11.1.5 Notice of usage.** When a flue is relined with a material not complying with Section 2113.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

## **2113.11.2 Concrete and masonry chimneys for medium-heat appliances.**

**2113.11.2.1 General.** Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113.1 through 2113.5.

**2113.11.2.2 Construction.** Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls a minimum of 8 inches (203 mm) thick, or with stone masonry a minimum of 12 inches (305 mm) thick.

**2113.11.2.3 Lining.** Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick a minimum of 4½ inches (114 mm) thick laid on the 4½-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

**2113.11.2.4 Multiple passageway.** Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

**2113.11.2.5 Termination height.** Concrete and masonry chimneys for medium-heat appliances shall extend a minimum of 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

**2113.11.2.6 Clearance.** A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

## **2113.11.3 Concrete and masonry chimneys for high-heat appliances.**

**2113.11.3.1 General.** Concrete and masonry chimneys for high-heat appliances shall comply with Sections 2113.1 through 2113.5.

**2113.11.3.2 Construction.** Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be a minimum of 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

**2113.11.3.3 Lining.** The inside of the interior wall shall be lined with an approved high-duty refractory brick, a minimum of 4½ inches (114 mm) thick laid on the 4½-inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

**2113.11.3.4 Termination height.** Concrete and masonry chimneys for high-heat appliances shall extend a minimum of 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

**2113.11.3.5 Clearance.** Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection

and maintenance operations on the chimney and prevent danger of burns to persons.

**2113.12 Clay flue lining (installation).** Clay flue liners shall be installed in accordance with ASTM C 1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope no greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty nonwater-soluble refractory mortar conforming to ASTM C 199 with tight mortar joints left smooth on the inside and installed to maintain an air space or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

### 2113.13 Additional requirements.

**2113.13.1 Listed materials.** Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

**2113.13.2 Space around lining.** The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

**Exception:** This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

**2113.14 Multiple flues.** When two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be at least 4 inches (102 mm) thick and bonded into the walls of the chimney.

**Exception:** When venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered at least 4 inches (102 mm).

**2113.15 Flue area (appliance).** Chimney flues shall not be smaller in area than the area of the connector from the appliance. Chimney flues connected to more than one appliance shall not be less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

#### Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *California Mechanical Code*.

**2113.16 Flue area (masonry fireplace).** Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113.16.1 or 2113.16.2.

**2113.16.1 Minimum area.** Round chimney flues shall have a minimum net cross-sectional area of at least  $\frac{1}{12}$  of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of at least  $\frac{1}{10}$  of the fireplace opening. Rectangular chimney flues with an aspect

ratio less than 2 to 1 shall have a minimum net cross-sectional area of at least  $\frac{1}{10}$  of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of at least  $\frac{1}{8}$  of the fireplace opening.

**2113.16.2 Determination of minimum area.** The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113.16. A flue size providing at least the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113.16(1) and 2113.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

**TABLE 2113.16(1)**  
**NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES<sup>a</sup>**

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10 $\frac{3}{4}$	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.

a. Flue sizes are based on ASTM C 315.

**TABLE 2113.16(2)**  
**NET CROSS-SECTIONAL AREA OF SQUARE  
AND RECTANGULAR FLUE SIZES**

FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 × 13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.

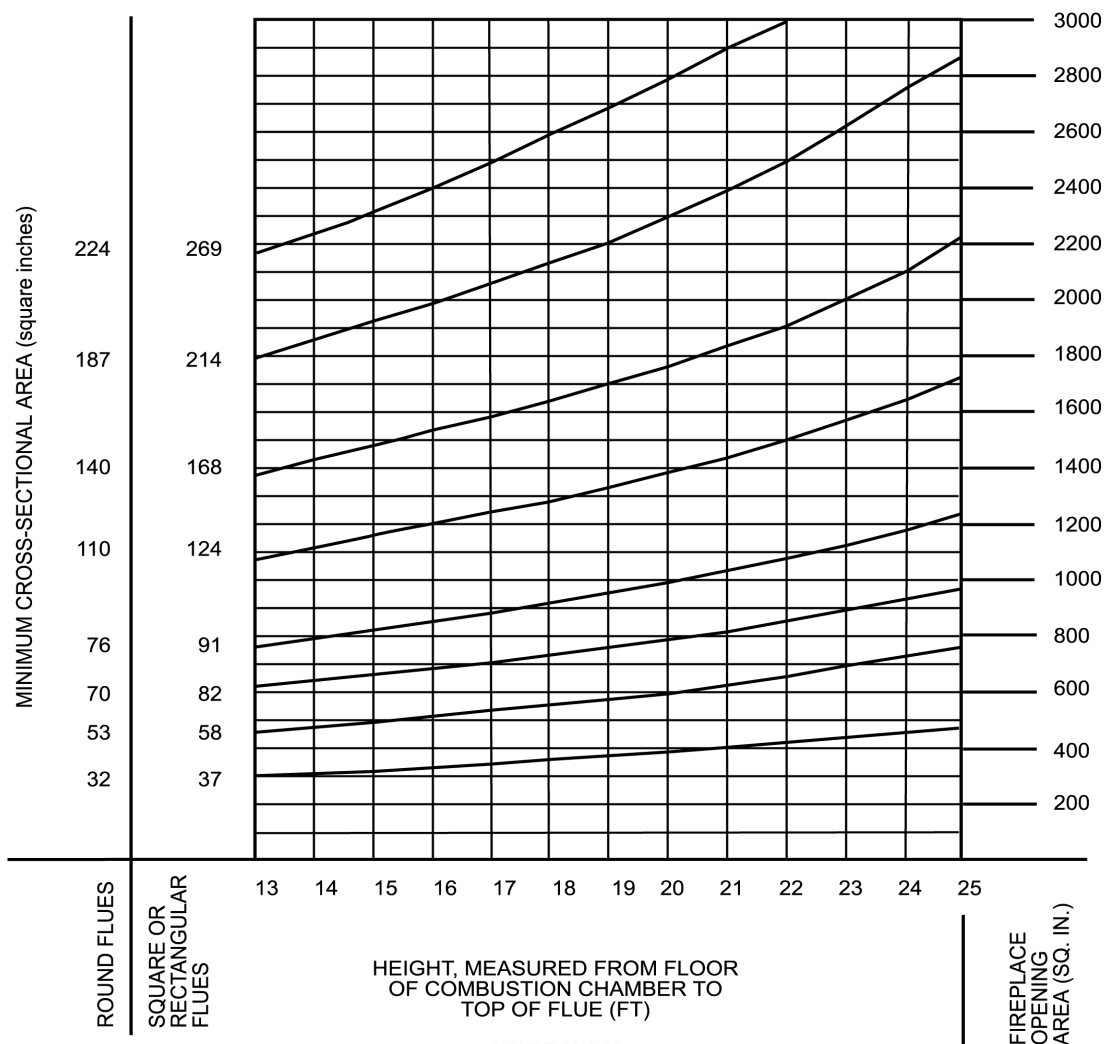


FIGURE 2113.16  
FLUE SIZES FOR MASONRY CHIMNEYS

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm<sup>2</sup>

FIGURE 2113.16  
FLUE SIZES FOR MASONRY CHIMNEYS

**2113.17 Inlet.** Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

**2113.18 Masonry chimney cleanout openings.** Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located at least 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be at least 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

**Exception:** Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

**2113.19 Chimney clearances.** Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys

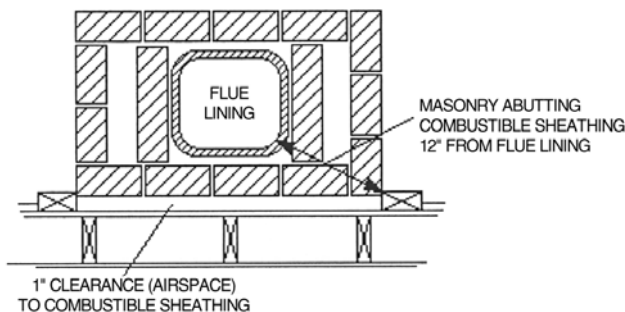
located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113.20.

**Exceptions:**

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.

3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113.19, provided such combustible trim or sheathing is a minimum of 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).

**2113.20 Chimney fireblocking.** All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.



**FIGURE 2113.19**  
**ILLUSTRATION OF EXCEPTION THREE CHIMNEY**  
**CLEARANCE PROVISION**

## **SECTION 2114** **ADDITIONAL REQUIREMENTS [DSA-SS/CC]**

**2114.1 General.** In addition to the provisions of this chapter, the following requirements shall apply to community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC).

**2114.1.1 Prohibitions.** The following design, systems and materials are not permitted by DSA:

1. Unreinforced masonry
2. Autoclaved aerated concrete (AAC) masonry
3. Empirical design of masonry
4. Ordinary reinforced masonry shear walls
5. Intermediate reinforced masonry shear walls
6. Prestressed masonry shear walls
7. Direct design of masonry

> **2114.2 Mortar.** Type S mortar conforming to ASTM C 270 shall be used for glass unit masonry.

### **2114.3 Additives and Admixtures.**

**2114.3.1 General.** Additives and admixtures to mortar or grout shall not be used unless approved by the enforcement agency.

**2114.3.2 Antifreeze compounds.** Antifreeze liquids, chloride salts or other such substances shall not be used in mortar or grout.

**2114.3.3 Air entrainment.** Air-entraining substances shall not be used in mortar or grout unless tests are conducted to determine compliance with the requirements of this code.

**2114.4 Tolerances.** The maximum thickness of the initial bed joint in fully grouted masonry walls shall not exceed  $1\frac{1}{4}$  in. (31.7 mm).

**2114.5 Glass unit masonry.** All mortar for glass unit masonry contact surfaces shall be treated to ensure adhesion between mortar and glass.

### **2114.6 Grouted masonry.**

**2114.6.1 General conditions.** Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than  $\frac{1}{4}$  inch (6.4 mm), mortar droppings and other foreign material.

All cells shall be solidly filled with grout, except as provided in Section 2114.14.

Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting. Reinforcement, embedded items and bolts shall be solidly embedded in grout. Anchor bolts in the face shells of hollow masonry units shall be positioned to maintain a minimum of  $\frac{1}{2}$  inch of grout between the bolt and the face shell.

The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour. At the time of laying, all masonry units shall be free of dust and dirt.

Grout pours greater than 12 inches (300 mm) in height shall be consolidated by mechanical vibration during placement to fill the grout space before loss of plasticity, and reconsolidated by mechanical vibration to minimize voids due to water loss. Grout pours less than 12 inches in height may be puddled.

Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of  $1\frac{1}{2}$  inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of  $\frac{1}{2}$  inch (12.7 mm) below the top of the masonry.

The construction documents shall completely describe grouting procedures, subject to approval of DSA.

**2114.7 Aluminum equipment.** Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.

**2114.8 Specified compressive strength.** The specified compressive strength,  $f'_m$ , assumed in design shall be not less than 1,500 psi (10.34 MPa) for all masonry construction using materials and details of construction required herein. Testing of the constructed masonry shall be provided in accordance with Section 2114.9.3.

In no case shall the  $f'_m$  assumed in design exceed 3,000 psi (20.68 MPa).

**2114.9 Additional testing requirements.**

**2114.9.1 Mortar and grout tests.** At the beginning of all masonry work, at least one test sample of the mortar and grout shall be taken on three successive working days and at least at one-week intervals thereafter. They shall meet the minimum strength requirement given in Sections 2103.9 and 2103.13 for mortar and grout, respectively. Additional samples shall be taken whenever any change in materials or job conditions occur, or whenever in the judgment of the architect, structural engineer or the enforcement agency such tests are necessary to determine the quality of the material. When the prism test method of Section 2105.2.2.2 is used during construction, the tests in this section are not required.

Test specimens for mortar and grout shall be made as set forth in ASTM C 1586 and ASTM C 1019

**2114.9.2 Prism test method.**

**2114.9.2.1 Number of prisms per test.** Prior to the start of construction, three prisms shall be constructed and tested in accordance with ASTM C 1314. A set of three masonry prisms shall be built during construction in accordance with ASTM C 1314 for each 5,000 square feet (465 m<sup>2</sup>) of wall area, but not less than one set of three prisms for the project. Each set of prisms shall equal or exceed  $f'_m$ .

**2114.9.3 Masonry core testing.** Not less than two cores shall be taken from each building for each 5,000 square feet (465 m<sup>2</sup>) of the greater of the masonry wall area or the floor area or fraction thereof. The architect or structural engineer in responsible charge of the project or his / her representative or the inspector of record shall select the areas for sampling. Cores shall be a minimum of 3-3/4" inches (76 mm) in diameter and shall be taken in such a manner as to exclude masonry unit webs and reinforcing steel. If vertical reinforcing steel is placed such that cores will include reinforcing steel, core testing may be waived by the design professional in responsible charge, as approved by the enforcement agency. The inspector of record shall observe the coring of the masonry walls.

Visual examination of all cores shall be made by a laboratory acceptable to the building official and the condition of the cores reported as required by the California Administrative Code. All cores taken shall be tested in shear. The shear test shall test both joints between the grout core and the outside wythes or face shell of the masonry. Shear testing apparatus shall be of a design approved by the enforcement agency. Core samples shall

not be soaked before testing. The average unit shear on the cross section of all the cores shall not be less than  $2.5\sqrt{f'_m}$  psi.

All cores shall be submitted to the laboratory, acceptable to the building official, for examination, regardless of whether the outside wythe or face shells separated during the cutting operation. The laboratory shall report the location where each core was taken, the findings of their visual examination of each core, and the results of the shear tests.

**2114.10 Modifications to TMS 402/ACI 530/ASCE 5.**

**2114.10.1** Modify TMS 402/ACI 530/ASCE 5, Section 1.18 as follows:

**1. Minimum reinforcement requirements for masonry walls.** The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equal matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402/ACI 530/ASCE 5 as modified by Sections 2107 and 2108 shall be considered as continuous reinforcement.

Horizontal reinforcement shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement elsewhere required.

When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.

Joint reinforcement shall not be used as principal reinforcement in masonry designed by the strength design method.

**2. Minimum reinforcement for masonry columns.**

The spacing of column ties shall be as follows: not greater than 8 bar diameters, 24 tie diameters, or one half the least dimension of the column for the full column height. Ties shall be at least  $\frac{3}{8}$ -inch (10 mm) in diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.

**3. Anchor bolts.** Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be  $\frac{1}{2}$ -inch (13 mm) diameter for 6-inch (152 mm) nominal masonry,  $\frac{3}{4}$ -inch (19 mm) diameter for 8-inch (203 mm) nominal masonry,  $\frac{7}{8}$ -inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25mm) diameter for 12-inch (304.8 mm) nominal masonry.

**2114.11 Additional requirements for allowable stress design.**

**2114.11.1 TMS 402/ACI 530/ASCE 5 [DSA-SS/CC]**

Modify by adding Section 2.1.8 as follows:

**2.1.8 – Walls and piers.**

**Thickness of walls.** For thickness limitations of walls as specified in this chapter, nominal thickness shall be used. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.

The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Also, no masonry wall shall exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 2114.11.1.

**Piers.** Every pier or wall section which width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section which width is between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.

**2114.11.2 TMS 402/ACI 530/ASCE 5, Section 2.1.7.7.1.1, lap splices.** Modify the requirements of Section 2107.2.1 by adding the following:

Lap splices need not be greater than 72 bar diameters.

**TABLE 2114.11.1  
MINIMUM THICKNESS OF MASONRY WALLS<sup>1,2</sup> [DSA-SS/CC]**

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS <sup>2,3</sup>	NOMINAL MINIMUM THICKNESS (inches)
<b>BEARING OR SHEAR WALLS:</b>		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow-unit masonry	25	6
<b>NONBEARING WALLS:</b>		
4. Exterior reinforced walls	30	6
5. Interior partitions reinforced	36	4

1. For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.
2. In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.
3. Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements

**2114.12 Glass unit masonry construction.** Masonry of glass blocks shall be permitted in nonload-bearing exterior or interior walls and shall conform to the requirements of Section 2114.14. Stresses in glass block shall not be utilized. Glass block may be solid or hollow and may contain inserts.

**2114.13 Nonbearing walls.** All nonbearing masonry walls shall be reinforced as specified in Section 2114.10.1.1. Fences and interior nonbearing nonshear walls may be of hollow-unit masonry construction grouted in cells containing vertical and horizontal reinforcement. Nonbearing walls may be used to carry a superimposed load of not more than 200 pounds per linear foot (2.92 kN/m).

1. **Thickness.** Every nonbearing masonry wall shall be so constructed and have a sufficient thickness to withstand all vertical loads and horizontal loads, but in no case shall the thickness of such walls be less than the values set forth in Table 2114.11.1.

Plaster shall not be considered as contributing to the thickness of a wall in computing the height-to-thickness ratio.

2. **Anchorage.** All nonbearing walls shall be anchored as required by Section 1604.8.2 and ASCE 7 Chapter 13. Suspended ceilings or other nonstructural elements shall not be used to provide anchorage for masonry walls.

**2114.14 Masonry screen walls.** Masonry units may be used in nonbearing decorative screen walls. Units may be laid up in panels with units on edge with the open pattern of the unit exposed in the completed wall.

1. **Horizontal forces.** The panels shall be capable of spanning between supports to resist the horizontal forces

specified in Chapter 16. Wind loads shall be based on gross projected area of the block.

2. **Mortar joints.** Horizontal and vertical joints shall not be less than  $\frac{1}{4}$  inch (6 mm) thick. All joints shall be completely filled with mortar and shall be "shoved joint" work. The units of a panel shall be so arranged that either the horizontal or the vertical joint containing reinforcing is continuous without offset. This continuous joint shall be reinforced with a minimum of 0.03 square inch (19 mm<sup>2</sup>) of reinforcing steel and maximum spacing of 16 in. on center. Reinforcement may be embedded in mortar.
3. **Reinforcement.** Joint reinforcement may be composed of two wires made with welded ladder or trussed wire cross ties. In calculating the resisting capacity of the system, compression and tension in the spaced wires may be utilized. Ladder wire reinforcement shall not be spliced and shall be the widest that the mortar joint will accommodate, allowing  $\frac{1}{2}$  inch (13 mm) of mortar cover.
4. **Size of panels.** The maximum size of panels shall be 144 square feet (13.4 m<sup>2</sup>), with the maximum dimension in either direction of 15 feet (4572 mm). The specified thickness of the units for exterior applications shall not be less than  $3\frac{7}{8}$  in.
5. **Panel support.** Each panel shall be supported on all edges by a structural member of concrete, masonry or steel. Supports at the top and ends of the panel shall be by means of confinement of the masonry by at least 1 inch (25 mm) into and between the flanges of a steel channel. The space between the end of the panel and the web of the channel shall be filled with resilient material. The use of equivalent configuration in other steel section or in masonry or concrete is acceptable.





## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 21A – MASONRY

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter							X		X			X								
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below		X																		
Chapter / Section																				
2113A.9.2		X																		



## CHAPTER 21A

# MASONRY

### SECTION 2101A GENERAL

**2101A.1 Scope.** This chapter shall govern the materials, design, construction and quality of masonry.

**2101A.1.1 Application.** *The scope of application of Chapter 21A is as follows:*

1. *Applications listed in Section 1.9.2.1 regulated by the Division of the State Architect-Structural Safety (DSA-SS). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Applications listed in Sections 1.10.1, and 1.10.4 regulated by the Office of Statewide Health Planning and Development (OSHDP). These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.*

**Exception:** *[OSHDP 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 21 and any applicable amendments therein.*

**2101A.1.2 Amendments in this chapter.** *DSA-SS adopts this chapter and all amendments.*

**Exception:** *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:*  
*[DSA-SS] For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Health Planning and Development:*  
*[OSHDP 1] - For applications listed in Section 1.10.1.*  
*[OSHDP 4] - For applications listed in Section 1.10.4.*

**2101A.1.3 Prohibition:** *The following design, systems, and materials are not permitted by DSA-SS and OSHDP:*

1. *Unreinforced masonry*
2. *Autoclaved aerated concrete (AAC) masonry*
3. *Empirical design of masonry*
4. *Adobe construction*
5. *Ordinary reinforced masonry shear walls*
6. *Intermediate reinforced masonry shear walls*
7. *Prestressed masonry shear walls*
8. *Direct design of masonry*

**2101A.2 Design methods.** Masonry shall comply with the provisions of one of the following design methods in this chapter as well as the requirements of Sections 2101A through 2104A. Masonry designed by the allowable stress design provisions of Section 2101A.2.1, or the strength design provisions of Section 2101A.2.2, shall comply with Section 2105A.

**2101A.2.1 Allowable stress design.** Masonry designed by the allowable stress design method shall comply with the provisions of Sections 2106A and 2107A.

**2101A.2.2 Strength design.** Masonry designed by the strength design method shall comply with the provisions of Sections 2106A and 2108A.

**2101A.2.3 Prestressed masonry.** *Not permitted by DSA and OSHPD.*

**2101A.2.4 Empirical design.** *Not permitted by DSA and OSHPD.*

**2101A.2.5 Glass unit masonry.** Glass unit masonry shall comply with the provisions of Section 2110A.

**2101A.2.6 Masonry veneer.** Masonry veneer shall comply with the provisions of Chapter 14.

**2101A.2.7 Direct design.** *Not permitted by DSA and OSHPD.*

**2101A.3 Construction documents.** The construction documents shall show all of the items required by this code including the following:

1. Specified size, grade, type and location of reinforcement, anchors and wall ties.
2. Reinforcing bars to be welded and welding procedure.
3. Size and location of structural elements.
4. Provisions for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature and moisture.
5. Loads used in the design of masonry.
6. Specified compressive strength of masonry at stated ages or stages of construction for which masonry is designed, except where specifically exempted by this code.
7. Details of anchorage of masonry to structural members, frames and other construction, including the type, size and location of connectors.
8. Size and permitted location of conduits, pipes and sleeves.
9. The minimum level of testing and inspection as defined in Chapter 17A, or an itemized testing and inspection program that meets or exceeds the requirements of Chapter 17A.

**2101A.3.1 Fireplace drawings.** The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

## **SECTION 2102A DEFINITIONS AND NOTATIONS**

**2102A.1 General.** The following terms are defined in Chapter 2, except those defined below which shall, for the purposes of this chapter, have the meanings shown herein:

**AAC MASONRY.**

**ADOBE CONSTRUCTION.**

A Adobe, stabilized.

A Adobe, unstabilized.

**ANCHOR.**

**ARCHITECTURAL TERRA COTTA.**

**AREA.**

G Gross cross-sectional.

N Net cross-sectional.

**AUTOCLAVED AERATED CONCRETE (AAC).**

**BED JOINT.**

**BOND BEAM.**

**BRICK.**

C Calcium silicate (sand lime brick).

C Clay or shale.

C Concrete.

**CAST STONE.**

**CELL.**

**CHIMNEY.**

**CHIMNEY TYPES.**

H High-heat appliance type.

L Low-heat appliance type.

M Masonry type.

M Medium-heat appliance type.

**CLEANOUT.**

**COLLAR JOINT.**

**COMPRESSIVE STRENGTH OF MASONRY.**

**DIMENSIONS.**

N Nominal.

S Specified.

**FIREPLACE.**

**FIREPLACE THROAT.**

**FOUNDATION PIER.**

**HEAD JOINT.**

**MASONRY.**

A Ashlar masonry.

C Coursed ashlar.

G Glass unit masonry.

P Plain masonry.

R Random ashlar.

R Reinforced masonry.

S Solid masonry.

U Unreinforced (plain) masonry.

**MASONRY UNIT.**

H Hollow.

S Solid.

**MORTAR.**

**MORTAR, SURFACE-BONDING.**

**PRESTRESSED MASONRY.**

**PRISM.**

**RUBBLE MASONRY.**

C Coursed rubble.

R Random rubble.

R Rough or ordinary rubble.

**RUNNING BOND.**

**SHEAR WALL.**

D Detailed plain masonry shear wall.

I Intermediate prestressed masonry shear wall.

I Intermediate reinforced masonry shear wall.

O Ordinary plain masonry shear wall.

O Ordinary plain prestressed masonry shear wall.

O Ordinary reinforced masonry shear wall.

S Special prestressed masonry shear wall.

S Special reinforced masonry shear wall.

**SPECIFIED.**

**SPECIFIED COMPRESSIVE STRENGTH OF MASONRY,  $f'_m$ .**

**STACK BOND.**

**STONE MASONRY.**

A Ashlar stone masonry.

R Rubble stone masonry.

**STRENGTH.**

D Design strength.

N Nominal strength.

R Required strength.

**THIN-BED MORTAR.**

**TIE, WALL.**

**TILE, STRUCTURAL CLAY.**

**WALL.****Cavity wall.****Composite wall.****Dry-stacked, surface-bonded wall.**

**Hollow-unit masonry wall.** Type of construction made with hollow masonry units in which the units are laid and set in mortar, reinforced and grouted solid except as provided in Section 2114A.

**Masonry-bonded hollow wall.****Parapet wall.****WYTHE.****NOTATIONS.**

$d_b$  = Diameter of reinforcement, inches (mm).

$F_s$  = Allowable tensile or compressive stress in reinforcement, psi (MPa).

$f_r$  = Modulus of rupture, psi (MPa).

$f'_{AAC}$  = Specified compressive strength of AAC masonry, the minimum compressive strength for a class of AAC masonry as specified in ASTM C 1386, psi (MPa).

$f'_m$  = Specified compressive strength of masonry at age of 28 days, psi (MPa).

$f'_{mi}$  = Specified compressive strength of masonry at the time of prestress transfer, psi (MPa).

$K$  = The lesser of the masonry cover, clear spacing between adjacent reinforcement, or five times  $d_b$ , inches (mm).

$L_s$  = Distance between supports, inches (mm).

$l_d$  = Required development length or lap length of reinforcement, inches (mm).

$P$  = The applied load at failure, pounds (N).

$S_t$  = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

$S_w$  = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

## SECTION 2103A MASONRY CONSTRUCTION MATERIALS

**2103A.1 Concrete masonry units.** Concrete masonry units shall conform to the following standards: ASTM C 55 for concrete brick; ASTM C 73 for calcium silicate face brick; ASTM C 90 for load-bearing concrete masonry units or ASTM C 744 for prefaced concrete and calcium silicate masonry units.

**2103A.2 Clay or shale masonry units.** Clay or shale masonry units shall conform to the following standards: ASTM C 34 for structural clay load-bearing wall tile; ASTM C 56 for structural clay nonload-bearing wall tile; ASTM C

62 for building brick (solid masonry units made from clay or shale); ASTM C 1088 for solid units of thin veneer brick; ASTM C 126 for ceramic-glazed structural clay facing tile, facing brick and solid masonry units; ASTM C 212 for structural clay facing tile; ASTM C 216 for facing brick (solid masonry units made from clay or shale); ASTM C 652 for hollow brick (hollow masonry units made from clay or shale) or ASTM C 1405 for glazed brick (single-fired solid brick units).

**Exception:** Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E 119 or UL 263 and shall comply with the requirements of Table 602.

**2103A.3 AAC masonry.** Not permitted by DSA and OSHPD. ||

**2103A.4 Stone masonry units.** Stone masonry units shall conform to the following standards: ASTM C 503 for marble building stone (exterior); ASTM C 568 for limestone building stone; ASTM C 615 for granite building stone; ASTM C 616 for sandstone building stone; or ASTM C 629 for slate building stone.

**2103A.5 Architectural cast stone.** Architectural cast stone shall conform to ASTM C 1364.

**2103A.6 Ceramic tile.** Ceramic tile shall be as defined in, and shall conform to the requirements of, ANSI A137.1.

**2103A.7 Glass unit masonry.** Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of  $\frac{3}{16}$  inch (4.8 mm). Solid glass-block units shall be provided when required. The surfaces of units intended to be in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. Reclaimed units shall not be used.

**2103A.8 Second-hand units.** Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

**2103A.9 Mortar.** Mortar for use in masonry construction shall conform to ASTM C 270 and Articles 2.1 and 2.6 A of TMS 602/ACI 530.1/ASCE 6, except for mortars listed in Section 2103A.10. Type S mortar conforming to ASTM C 270 shall be used for glass unit masonry <

**2103A.10 Surface-bonding mortar.** Surface-bonding mortar shall comply with ASTM C 887. Surface bonding of concrete masonry units shall comply with ASTM C 946. <

**2103A.11 Mortars for ceramic wall and floor tile.** Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103A.11.

**TABLE 2103A.11  
CERAMIC TILE MORTAR COMPOSITIONS**

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $\frac{1}{5}$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $\frac{1}{2}$ hydrated lime; 5 damp sand to 1 cement 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $\frac{1}{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $\frac{1}{2}$ hydrated lime; $2\frac{1}{2}$ dry sand or 3 damp sand

**2103A.11.1 Dry-set portland cement mortars.** Premixed prepared portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set portland cement mortar shall be installed in accordance with ANSI A108.5.

**2103A.11.2 Latex-modified portland cement mortar.** Latex-modified portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified portland cement shall be installed in accordance with ANSI A108.5.

**2103A.11.3 Epoxy mortar.** Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

**2103A.11.4 Furan mortar and grout.** Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

**2103A.11.5 Modified epoxy-emulsion mortar and grout.** Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

**2103A.11.6 Organic adhesives.** Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall not be less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

**2103A.11.7 Portland cement grouts.** Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

**2103A.12 Mortar for AAC masonry.** Not permitted by DSA and OSHPD.

**2103A.13 Grout.** Grout shall comply with Article 2.2 of TMS 602/ACI 530.1/ASCE 6.

**2103A.13.1 Water.** Water content shall be adjusted to provide proper workability and to enable proper placement under existing field conditions, without segregation.

**2103A.13.2 Selecting proportions.** Proportions of ingredients and any additives shall be based on laboratory or field experience with the grout ingredients and the masonry units to be used. Coarse grout proportioned by weight shall contain not less than 564 pounds of cementitious material per cubic yard (335 kg/m<sup>3</sup>). <

**2103A.13.3 Aggregate.** Coarse grout shall be used in grout spaces 2 inches (51 mm) or more in width and in all filled-cell masonry construction.

**2103A.14 Metal reinforcement and accessories.** Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602/ACI 530.1/ASCE 6. Where unidentified reinforcement is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work.

**2103A.15 Additives and admixtures.**

**2103A.15.1 General.** Additives and admixtures to mortar or grout shall not be used unless approved by the enforcement agency.

**2103A.15.2 Antifreeze compounds.** Antifreeze liquids, chloride salts or other such substances shall not be used in mortar or grout.

**2103A.15.3 Air entrainment.** Air-entraining substances shall not be used in mortar or grout unless tests are conducted to determine compliance with the requirements of this code.

## SECTION 2104A CONSTRUCTION

**2104A.1 Masonry construction.** Masonry construction shall comply with the requirements of Sections 2104A.1.1 through 2104A.5 and with TMS 602/ACI 530.1/ASCE 6.

**2104A.1.1 Tolerances.** Masonry, except masonry veneer, shall be constructed within the tolerances specified in TMS 602/ACI 530.1/ASCE 6.

**Exception:** The maximum thickness of the initial bed joint in fully grouted masonry walls shall not exceed  $1\frac{1}{4}$  inches (31.7 mm).

**2104A.1.2 Placing mortar and units.** Placement of mortar, grout, and clay, concrete, and glass, masonry units shall comply with TMS 602/ACI 530.1/ASCE 6. All mortar for glass unit masonry contact surfaces shall be treated to ensure adhesion between mortar and glass. <

**2104A.1.3 Installation of wall ties.** Wall ties shall be installed in accordance with TMS 602/ACI 530.1/ASCE 6.

**2104A.1.4 Chases and recesses.** Chases and recesses shall be constructed as masonry units are laid. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on lintels.

**2104A.1.5 Lintels.** The design for lintels shall be in accordance with the masonry design provisions of either Section 2107A or 2108A.

**2104A.1.6 Support on wood.** Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.12.

**2104A.2 Corbeled masonry.** Corbeled masonry shall comply with the requirements of Section 1.12 of TMS 402/ACI 530/ASCE 5.

**2104A.2.1 Molded cornices.** Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

**2104A.3 Cold weather construction.** The cold weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 C, shall be implemented when the ambient temperature falls below 40°F (4°C).

**2104A.4 Hot weather construction.** The hot weather construction provisions of TMS 602/ACI 530.1/ASCE 6, Article 1.8 D, shall be implemented when the ambient air temperature exceeds 100°F (37.8°C), or 90°F (32.2°C) with a wind velocity greater than 8 mph (12.9 km/hr).

#### **2104A.5 Grouted masonry.**

**2104A.5.1 General conditions.** Grouted masonry shall be constructed in such a manner that all elements of the masonry act together as a structural element. At the time of laying, all masonry units shall be free of dust and dirt. Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than  $\frac{1}{4}$  inch (6.4 mm), mortar droppings and other foreign material. Grout shall be placed so that all spaces to be grouted do not contain voids.

Grout materials and water content shall be controlled to provide adequate fluidity for placement without segregation of the constituents, and shall be mixed thoroughly. Segregation of the grout materials and damage to the masonry shall be avoided during the grouting process.

Reinforcement and embedded items shall be clean, properly positioned and securely anchored against movement prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting. Reinforcement, embedded items and bolts shall be solidly embedded in grout. Anchor bolts in the face shells of hollow masonry units shall be positioned to maintain a minimum of  $\frac{1}{2}$  in. of grout between the bolt and the face shell.

The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.

Grout pours greater than 12 inches (300 mm) in height shall be consolidated by mechanical vibration during placement to fill the grout space before loss of plasticity, and reconsolidated by mechanical vibration to minimize voids due to water loss. Grout pours less than 12 inches in height may be puddled.

Between grout pours, or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of  $1\frac{1}{2}$  inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of  $\frac{1}{2}$  inch (12.7 mm) below the top of the masonry.

Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.

#### **2104A.5.1.1 Reinforced grouted masonry.**

**2104A.5.1.1.1 General.** Reinforced grouted masonry is that form of construction made with clay or shale brick or made with solid concrete building brick in which interior joints of masonry are filled by pouring grout around reinforcement therein as the work progresses.

**2104A.5.1.1.1 Low-lift grouted construction.** Requirements for construction shall be as follows:

1. All units in the two outer wythes shall be laid with full-shoved head joint and bed mortar joints. Masonry headers shall not project into the grout space.
2. The minimum grout space for low-lift grout masonry shall be  $2\frac{1}{2}$  inches (64 mm). All reinforcement and wire ties shall be embedded in the grout. The thickness of the grout between masonry units and reinforcement shall be a minimum of one bar diameter.
3. One tier of a grouted reinforced masonry wall may be carried up 12 inches (305 mm) before grouting, but the other tier shall be laid up and grouted in lifts not to exceed one masonry unit in height. All grout shall be puddled with a mechanical vibrator or wood stick immediately after placing so as to completely fill all voids and to consolidate the grout. All vertical and horizontal steel shall be held firmly in place by a frame or suitable devices.
4. Toothing of masonry walls is prohibited. Racking is to be held to a minimum.

**2104A.5.1.1.1.2 High-lift grouted construction.** Where high-lift grouting is used, the method shall



be subject to the approval of the enforcement agency. Requirements for construction shall be as follows:

1. All units in the two wythes shall be laid with full head and bed mortar joints.
2. The two wythes shall be bonded together with wall ties. Ties shall not be less than No. 9 wire in the form of rectangles 4 inches (102 mm) wide and 2 inches (51 mm) in length less than the overall wall thickness. Kinks, water drips, or deformations shall not be permitted in the ties. One tier of the wall shall be built up not more than 16 inches (406 mm) ahead of the other tier. Ties shall be laid not to exceed 24 inches (610 mm) on center horizontally and 16 inches (406 mm) on center vertically for running bond, and not more than 24 inches (610 mm) on center horizontally and 12 inches (305 mm) on center vertically for stack bond.
3. Cleanouts shall be provided for each pour by leaving out every other unit in the bottom tier of the section being poured or by cleanout openings in the foundation. The foundation or other horizontal construction joints shall be cleaned of all loose material and mortar droppings before each pour. The cleanouts shall be sealed after inspection and before grouting.
4. The grout space in high-lift grouted masonry shall be a minimum of 3½ inches (89 mm). All reinforcement and wire ties shall be embedded in the grout. The thickness of the grout between masonry units and reinforcement shall be a minimum of one bar diameter.
5. Vertical grout barriers or dams of solid masonry shall be built across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall be spaced not more than 30 feet (9144 mm) apart.
6. An approved admixture of a type that reduces early water loss and produces an expansive action shall be used in high-lift grout.
7. Grouting shall be done in a continuous pour in lifts not exceeding 4 feet (1219 mm). Grout shall be consolidated by mechanical vibration only, and shall be reconsolidated after excess moisture has been absorbed, but before plasticity is lost. The grouting of any section of a wall between control barriers shall be completed in one day, with no interruptions greater than one hour.

#### 2104A.5.1.2 Reinforced hollow-unit masonry.

**2104A.5.1.2.1 General.** Reinforced hollow-unit masonry is that type of construction made with hollow-masonry units in which cells are continuously filled with grout, and in which reinforcement is embedded. All cells shall be solidly filled with grout in reinforced hollow-unit masonry, except as provided in Section 2114A.1. Construction shall be one of the two following methods: The low-lift method where the maximum height of construction laid before grouting is 4 feet (1220 mm), or the high-lift method where the full height of construction between horizontal cold joints is grouted in one operation. General requirements for construction shall be as follows:

1. Bond shall be provided by lapping units in successive vertical courses. Where stack bond is used in reinforced hollow-unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.
2. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear unobstructed, continuous vertical cell measuring not less than 2 inches by 3 inches (51 mm by 76 mm), except the minimum cell dimension for high-lift grout shall be 3 inches (76 mm).
3. Grout shall be a workable mix suitable for placing without segregation and shall be thoroughly mixed. Grout shall be placed by pumping or an approved alternate method and shall be placed before initial set or hardening occurs. Grout shall be consolidated by mechanical vibration during placing and reconsolidated after excess moisture has been absorbed, but before workability is lost.
4. All reinforcement and wire ties shall be embedded in the grout. The space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter.
5. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above steel for each grout pour. The depth of the bond beam channel below the top of the unit shall be a minimum of 1½ inches (38 mm) and the width shall be 3 inches (76 mm) minimum.

**2104A.5.1.2.1.1 Low-lift grouted construction.** Units shall be laid a maximum of 4 feet (1220 mm) before grouting. Grouting shall follow each 4 feet (1220 mm) of construction laid and shall be consolidated so as to completely fill all voids and embed all reinforcing steel. Horizontal reinforcement shall be fully embedded in grout in an uninterrupted pour.

**2104A.5.1.2.1.2 High-lift grouted construction.** Where high-lift grouting is used, the method shall

be approved by the enforcement agency. Cleanout openings shall be provided in every cell at the bottom of each pour of grout. Alternatively, if the course at the bottom of the pour is constructed entirely of inverted open-end bond beam units, cleanout openings need only be provided for access to every reinforced cell at the bottom of each pour of grout. The cleanouts shall be sealed before grouting. An approved admixture that reduces early water loss and produces an expansive action shall be used in the grout.

## SECTION 2105A QUALITY ASSURANCE

**2105A.1 General.** A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17A.

**2105A.2 Acceptance relative to strength requirements.** Where required by Chapter 17A, verification of the strength of masonry shall be in accordance with Sections 2105A.2.1 and 2105A.2.2.

**2105A.2.1 Compliance with  $f'_m$ .** Compressive strength of masonry shall be considered satisfactory if the compressive strength of each masonry wythe and grouted collar joint equals or exceeds the value of  $f'_m$  for clay and concrete masonry and requirements of Section 2105A.2.2 are satisfied. For partially grouted clay and concrete masonry, the compressive strength of both the grouted and ungrouted masonry shall equal or exceed the applicable  $f'_m$ . The specified compressive strength,  $f'_m$ , assumed in design shall be 1,500 psi (10.34 MPa) for all masonry construction using materials and details of construction required herein. Testing of the constructed masonry shall be provided in accordance with Section 2105A.4 [OSHPD 1 & 4] or 2105A.5 [DSA-SS].

**Exception: [DSA-SS]** Subject to the approval of the enforcement agency, higher values of  $f'_m$  may be used in the design of reinforced grouted masonry and reinforced hollow-unit masonry. The approval shall be based on prism test results submitted by the architect or engineer which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength and stiffness. The design shall take into account the mortar joint depth. In no case shall the  $f'_m$  assumed in design exceed 3,000 psi (20.7 MPa).

Where an  $f'_m$  greater than 1,500 psi (10.34 MPa) is approved, the architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract specifications. Compliance with the requirements for the specified compressive strength of masonry  $f'_m$  shall be provided in accordance with Section 2105A.2.2.1 or 2105A.2.2.2. Substantiation for the specified compressive strength prior to the start of construction shall be

obtained in accordance with Section 2105A.2.2.2.2. Testing of the constructed masonry shall be provided in accordance with Section 2105A.5.

**Exception: [OSHPD 1 & 4]** Subject to the approval of the enforcement agency, higher values of  $f'_m$  may be used in the design of reinforced grouted masonry and reinforced hollow-unit masonry. The approval shall be based on prism test results submitted by the architect or engineer which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength and stiffness. The design shall assume that the reinforcement will be placed in a location that will produce the largest stresses within the tolerances allowed in Section 2104A.1.1 and shall take into account the mortar joint depth. In no case shall the  $f'_m$  assumed in design exceed 3,000 psi (20.7 MPa).

Where an  $f'_m$  greater than 1,500 psi (10.34 MPa) is approved, the architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract specifications. Compliance with the requirements for the specified strength of constructed masonry shall be provided in accordance with Sections 2105A.2.2.2 and 2105A.4. Substantiation for the specified compressive strength prior to the start of construction shall be obtained in accordance with Sections 2105A.2.2.2.2 and 2105A.2.2.1.4.

**2105A.2.2 Determination of compressive strength.** The compressive strength for each wythe shall be determined by the unit strength method or by the prism test method as specified herein.

**2105A.2.2.1 Unit strength method.** The determination of compressive strength by the unit strength method shall be in accordance with Section 2105A.2.2.1.1 for clay masonry and Section 2105A.2.2.1.2 for concrete masonry.

**2105A.2.2.1.1 Clay masonry.** The compressive strength of masonry shall be determined based on the strength of the units and the type of mortar specified using Table 2105A.2.2.1.1, provided:

1. Units are sampled and tested to verify compliance with ASTM C 62, ASTM C 216 or ASTM C 652.
2. Thickness of bed joints does not exceed  $\frac{5}{8}$  inch (15.9 mm).
3. For grouted masonry, the grout meets one of the following requirements:
  - 3.1. Grout conforms to Article 2.2 of TMS 602/ACI 530.1/ASCE 6.
  - 3.2. Minimum grout compressive strength equals or exceeds  $f'_m$  but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

**TABLE 2105A.2.2.1.1  
COMPRESSIVE STRENGTH OF CLAY MASONRY**

NET AREA COMPRESSIVE STRENGTH OF CLAY MASONRY UNITS (psi)		NET AREA COMPRESSIVE STRENGTH OF MASONRY (psi)
Type M or S mortar	Type N mortar	
1,700	2,100	1,000
3,350	4,150	1,500
4,950	6,200	2,000
6,600	8,250	2,500
8,250	10,300	3,000
9,900	—	3,500
11,500	—	4,000

For SI: 1 pound per square inch = 0.00689 MPa.

**2105A.2.2.1.2 Concrete masonry.** The compressive strength of masonry shall be determined based on the strength of the unit and type of mortar specified using Table 2105A.2.2.1.2, provided:

- Units are sampled and tested to verify compliance with ASTM C 55 or ASTM C 90.
- Thickness of bed joints does not exceed  $\frac{5}{8}$  inch (15.9 mm).
- For grouted masonry, the grout meets one of the following requirements:
  - Grout conforms to Article 2.2 of TMS 602/ACI 530.1/ASCE 6.
  - Minimum grout compressive strength equals or exceeds  $f'_m$  but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

**TABLE 2105A.2.2.1.2  
COMPRESSIVE STRENGTH OF CONCRETE MASONRY**

NET AREA COMPRESSIVE STRENGTH OF CONCRETE MASONRY UNITS (psi)		NET AREA COMPRESSIVE STRENGTH OF MASONRY (psi) <sup>a</sup>
Type M or S mortar	Type N mortar	
1,250	1,300	1,000
1,900	2,150	1,500
2,800	3,050	2,000
3,750	4,050	2,500
4,800	5,250	3,000

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

a. For units less than 4 inches in height, 85 percent of the values listed.

**2105A.2.2.1.3 AAC masonry.** *Not permitted by the DSA.*

**2105A.2.2.1.4 Mortar and grout tests.** *These tests are to establish whether the masonry components meet the specified component strengths. At the beginning of all masonry work, at least one test sample of the mortar and grout shall be taken on three successive working days and at least at one-week intervals thereafter. They shall meet the minimum strength requirement given in Sections 2103A.9 and 2103A.13 for mortar and grout, respectively. Addi-*

*tional samples shall be taken whenever any change in materials or job conditions occur, or whenever in the judgment of the architect, structural engineer or the enforcement agency such tests are necessary to determine the quality of the material. When the prism test method of Section 2105A.2.2.2 is used during construction, the tests in this section are not required.*

*Test specimens for mortar and grout shall be made as set forth in ASTM C 1586 and ASTM C 1019*

**2105A.2.2.2 Prism test method.** The determination of compressive strength by the prism test method shall be in accordance with Sections 2105A.2.2.2.1 and 2105A.2.2.2.2.

**2105A.2.2.2.1 General.** The compressive strength of clay and concrete masonry shall be determined by the prism test method *prior to the start of construction and during construction:*

- Where specified in the construction documents.
- Where masonry does not meet the requirements for application of the unit strength method in Section 2105A.2.2.1.
- Where required by Section 2105A.2.1.

**2105A.2.2.2.2 Number of prisms per test.** *Prior to the start of construction, a prism test shall consist of five prisms constructed and tested in accordance with ASTM C 1314. A set of three masonry prisms shall be built during construction in accordance with ASTM C 1314 for each 5,000 square feet (465 m<sup>2</sup>) of wall area, but not less than one set of three prisms for the project. Each set of prisms shall equal or exceed  $f'_m$ .*

**2105A.3 Testing prisms from constructed masonry.** When approved by the building official, acceptance of masonry that does not meet the requirements of Section 2105A.2.2.1, 2105A.2.2.2, 2105A.4, 2105A.5 or 2105A.2.2.1.4 shall be permitted to be based on tests of prisms cut from the masonry construction in accordance with Sections 2105A.3.1, 2105A.3.2 and 2105A.3.3.

**2105A.3.1 Prism sampling and removal.** A set of three masonry prisms that are at least 28 days old shall be saw cut from the masonry for each 5,000 square feet (465 m<sup>2</sup>) of the wall area that is in question but not less than one set of three masonry prisms for the project. The length, width and height dimensions of the prisms shall comply with the requirements of ASTM C 1314. Transporting, preparation and testing of prisms shall be in accordance with ASTM C 1314.

**2105A.3.2 Compressive strength calculations.** The compressive strength of prisms shall be the value calculated in accordance ASTM C 1314, except that the net cross-sectional area of the prism shall be based on the net mortar bedded area.

**2105A.3.3 Compliance.** Compliance with the requirement for the specified compressive strength of masonry,  $f'_m$ , shall be considered satisfied provided the modified compressive strength equals or exceeds the specified  $f'_m$ . Additional testing of specimens cut from locations in question shall be permitted.

- 2105A.4 Masonry core testing. [OSHDP 1 & 4]** Not less than two cores shall be taken from each building for each 5,000 square feet (465 m<sup>2</sup>) of the greater of the masonry wall area or the floor area or fraction thereof. The architect or structural engineer in responsible charge of the project or his or her representative or the inspector of record shall select the areas for sampling. Cores shall be a minimum of 3<sup>3</sup>/<sub>4</sub> inches (76 mm) in diameter and shall be taken in such a manner as to exclude masonry unit webs and reinforcing steel. The inspector of record or testing agency shall inspect the coring of the masonry walls.

Visual examination of all cores shall be made by a laboratory acceptable to the building official and the condition of the cores reported as required by the California Administrative Code. One half of the number of cores taken shall be tested in shear. The shear test shall test both joints between the grout core and the outside wythes or face shells of the masonry. Shear testing apparatus shall be of a design approved by the enforcement agency. Core samples shall not be soaked before testing. The unit shear on the cross section of the core shall not be less than  $2.5 \sqrt{f'_m}$  psi.

All cores shall be submitted to the laboratory, acceptable to the building official, for examination regardless of whether the core specimens failed during the cutting operation. The laboratory shall report the location where each core was taken, the findings of their visual examination of each core, identify which cores were selected for shear testing and the results of the shear tests.

**2105A.5 [DSA-SS] (Chapter 21, Section 2114.9.3) Masonry core testing.** Not less than two cores shall be taken from each building for each 5,000 square feet (465 m<sup>2</sup>) of the greater of the masonry wall area or the floor area or fraction thereof. The architect or structural engineer in responsible charge of the project or his/her representative or the inspector of record shall select the areas for sampling. Cores shall be a minimum of 3<sup>3</sup>/<sub>4</sub> inches (76 mm) in diameter and shall be taken in such a manner as to exclude masonry unit webs and reinforcing steel. If vertical reinforcing steel is placed such that cores will include reinforcing steel, core testing may be waived by the design professional in responsible charge, as approved by the enforcement agency. The inspector of record shall observe the coring of the masonry walls.

Visual examination of all cores shall be made by a laboratory acceptable to the building official and the condition of the cores reported as required by the California Administrative Code. All cores taken shall be tested in shear. The shear test shall test both joints between the grout core and the outside wythes or face shell of the masonry. Shear testing apparatus shall be of a design approved by the enforcement agency. Core samples shall not be soaked before testing. The average unit shear on the cross section of all the cores shall not be less than  $2.5 \sqrt{f'_m}$  psi.

All cores shall be submitted to the laboratory, acceptable to the building official, for examination, regardless of whether the outside wythe or face shells separated during the cutting operation. The laboratory shall report the location where each core was taken, the findings of their visual examination of each core, and the results of the shear tests.

## SECTION 2106A SEISMIC DESIGN

**2106A.1 Seismic design requirements for masonry.** Masonry structures and components shall comply with the requirements in Section 1.18 of TMS 402/ACI 530/ASCE 5 depending on the structure's seismic design category.

### 2106A.1.1 Modifications to TMS 402/ACI 530/ASCE 5.

Modify TMS 402/ACI 530/ASCE 5/Section 1.18 as follows:

- 1. Minimum reinforcement requirements for masonry walls.** The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equal matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402/ACI 530/ASCE 5 as modified by Section 2107A and 2108A shall be considered as continuous reinforcement.

Horizontal reinforcement shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement elsewhere required.

When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.

Joint reinforcement shall not be used as principal reinforcement in masonry designed by the strength design method.

**2. Minimum reinforcement for masonry columns.**

The spacing of column ties shall be as follows: not greater than 8 bar diameters, 24 tie diameters, or one half the least dimension of the column for the full column height. Ties shall be at least  $\frac{3}{8}$ -inch (10 mm) diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.

**3. Lateral support.** Lateral support of masonry may be provided by cross walls, columns, pilasters, counterforts or buttresses where spanning horizontally or by floors, beams, girts or roofs where spanning vertically. Where walls are supported laterally by vertical elements, the stiffness of each vertical element shall exceed that of the tributary area of the wall.

**4. Anchor bolts.** Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be  $\frac{1}{2}$ -inch (13 mm) diameter for 6-inch (152 mm) nominal masonry,  $\frac{3}{4}$ -inch (19 mm) diameter for 8-inch (203 mm) nominal masonry,  $\frac{7}{8}$ -inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.

## SECTION 2107A ALLOWABLE STRESS DESIGN

**2107A.1 General.** The design of masonry structures using allowable stress design shall comply with Section 2106A and the requirements of Chapters 1 and 2 of TMS 402/ACI 530/ASCE 5 except as modified by Sections 2107A.2 through 2107A.6.

**2107A.2 TMS 402/ACI 530/ASCE 5, Section 2.1.7.7.1.1, lap splices.** In lieu of Section 2.1.7.7.1.1, it shall be permitted to design lap splices in accordance with Section 2107A.2.1.

**2107A.2.1 Lap splices.** The minimum length of lap splices for reinforcing bars in tension or compression,  $l_d$ , shall be

$$l_d = 0.002d_b f_s \quad (\text{Equation 21A-1})$$

For SI:  $l_d = 0.29d_b f_s$

but not less than 12 inches (305 mm). In no case shall the length of the lapped splice be less than 40 bar diameters, and need not be greater than 72 bar diameters.

where:

$d_b$  = Diameter of reinforcement, inches (mm).

$f_s$  = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress,  $F_s$ , the lap length of splices shall be increased not less than 50 percent of the minimum required length. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

**2107A.3 TMS 402/ACI 530/ASCE 5, Section 2.1.7.7, splices of reinforcement.** Modify Section 2.1.7.7 as follows:

**2.1.7.7 Splices of reinforcement.** Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. All welding shall conform to AWS D1.4. Welded splices shall be of ASTM A 706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section 2.1.7.7.3.

**2107A.4 TMS 402/ACI 530/ASCE 5, Section 2.3.7, maximum bar size.** Add the following to Chapter 2:

**2.3.7 Maximum bar size.** The bar diameter shall not exceed one-eighth of the nominal wall thickness and shall not exceed one-quarter of the least dimension of the cell, course or collar joint in which it is placed.

**2107A.5 TMS 402/ACI 530/ASCE 5.** Modify by adding Section 2.1.8, as follows:

**2.1.8 - Walls and Piers.**

**Thickness of Walls.** For thickness limitations of walls as specified in this chapter, nominal thickness shall be used. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.

The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Also, no masonry wall shall exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 2107A.5, below.

**Piers.** Every pier or wall section which width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section which width is between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.

**2107A.6 [OSHPD 1 & 4] Modify TMS402/ACI 530/ASCE 5, Section 2.3.4.4 by the following:**

All reinforced masonry components that are subjected to in-plane forces shall have a maximum reinforcement ratio,  $\rho_{max}$ , not greater than that computed by Equation 2-23.

**TABLE 2107A.5  
MINIMUM THICKNESS OF MASONRY WALLS<sup>1,2</sup>**

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS <sup>2,3</sup>	NOMINAL MINIMUM THICKNESS (inches)
<b>BEARING OR SHEAR WALLS:</b>		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow-unit masonry	25	6
<b>NONBEARING WALLS:</b>		
4. Exterior reinforced walls	30	6
5. Interior partitions reinforced	36	4

1. For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.
2. In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.
3. Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.

## SECTION 2108A STRENGTH DESIGN OF MASONRY

**2108A.1 General.** The design of masonry structures using strength design shall comply with Section 2106A and the requirements of Chapters 1 and 3 of TMS 402/ACI 530/ASCE 5, except as modified by Sections 2108A.2 through 2108A.3.

**2108A.2 TMS 402/ACI 530/ASCE 5, Section 3.3.3.3 development.** Modify the second paragraph of Section 3.3.3.3 as follows:

The required development length of reinforcement shall be determined by Equation (3-16), but shall not be less than 12 inches (305 mm) and need not be greater than  $72d_b$ .

**2108A.3 TMS 402/ACI 530/ASCE 5, Section 3.3.3.4, splices.** Modify items (b) and (c) of Section 3.3.3.4 as follows:

3.3.3.4 (c). A welded splice shall have the bars butted and welded to develop at least 125 percent of the yield strength,  $f_y$ , of the bar in tension or compression, as required. Welded splices shall be of ASTM A 706 steel reinforcement. Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls or special moment frames of masonry.

3.3.3.4 (d). Mechanical splices shall be classified as Type 1 or 2 according to Section 21.2.6.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls or special moment frames. Type 2 mechanical splices are permitted in any location within a member.

## SECTION 2109A EMPIRICAL DESIGN OF MASONRY Not permitted by OSHPD and DSA.

## SECTION 2110A GLASS UNIT MASONRY

**2110A.1 General.** Masonry of glass blocks shall be permitted in nonload-bearing exterior or interior walls and shall conform to the requirements of Section 2115A. Stresses in glass block shall not be utilized. Glass block may be solid or hollow and may contain inserts.

## SECTION 2111A MASONRY FIREPLACES

**2111A.1 Definition.** A masonry fireplace is a fireplace constructed of concrete or masonry. Masonry fireplaces shall be constructed in accordance with this section.

**2111A.2 Footings and foundations.** Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

**2111A.2.1 Ash dump cleanout.** Cleanout openings, located within foundation walls below fireboxes, when provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

**2111A.3 Seismic reinforcing.** In structures assigned to Seismic Design Category A or B, reinforcement and seismic anchorage are not required. Masonry or concrete fireplaces shall be constructed, anchored, supported and reinforced as required in this chapter. In structures assigned to Seismic Design Category C or D, masonry and concrete fireplaces shall be reinforced and anchored as detailed in Sections 2111A.3.1, 2111A.3.2, 2111A.4 and 2111A.4.1 for chimneys serving fireplaces. In structures assigned to Seismic Design Category E or F, masonry and concrete chimneys shall be reinforced in accordance with the requirements of Sections 2101A through 2108A.

**2111A.3.1 Vertical reinforcing.** For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103A.12. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

**2111A.3.2 Horizontal reinforcing.** Vertical reinforcement shall be placed enclosed within  $\frac{1}{4}$ -inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at a minimum of every 18 inches (457 mm) of vertical height. Two

such ties shall be provided at each bend in the vertical bars.

**2111A.4 Seismic anchorage.** Masonry and concrete chimneys in structures assigned to Seismic Design Category C or D shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the following requirements.

**2111A.4.1 Anchorage.** Two  $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25.4 mm) straps shall be embedded a minimum of 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to a minimum of four floor joists with two  $\frac{1}{2}$ -inch (12.7 mm) bolts.

**2111A.5 Firebox walls.** Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. When a lining of firebrick at least 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and sidewalls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall not be greater than  $\frac{1}{4}$  inch (6.4 mm). When no lining is provided, the total minimum thickness of back and sidewalls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C 27 or ASTM C 1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C 199.

**2111A.5.1 Steel fireplace units.** Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than  $\frac{1}{4}$  inch (6.4 mm) in thickness, and an air-circulating chamber which is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

**2111A.6 Firebox dimensions.** The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall not be less than 8 inches (203 mm) above the fireplace opening. The throat opening shall not be less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall not be less than the cross-sectional area of the flue.

**Exception:** Rumford fireplaces shall be permitted provided that the depth of the fireplace is at least 12 inches (305 mm) and at least one-third of the width of the fireplace opening, and the throat is at least 12 inches (305 mm) above the lintel, and at least  $\frac{1}{20}$  the cross-sectional area of the fireplace opening.

**2111A.7 Lintel and throat.** Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace

throat or damper shall be located a minimum of 8 inches (203 mm) above the top of the fireplace opening.

**2111A.7.1 Damper.** Masonry fireplaces shall be equipped with a ferrous metal damper located at least 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

**2111A.8 Smoke chamber walls.** Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C 199. When a lining of firebrick at least 2 inches (51 mm) thick, or a lining of vitrified clay at least  $\frac{5}{8}$  inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C 1261 and shall be laid with refractory mortar conforming to ASTM C 199. Vitrified clay linings shall conform to ASTM C 315.

**2111A.8.1 Smoke chamber dimensions.** The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical when prefabricated smoke chamber linings are used or when the smoke chamber walls are rolled or sloped rather than corbeled. When the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

**2111A.9 Hearth and hearth extension.** Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. No combustible material shall remain against the underside of hearths or hearth extensions after construction.

**2111A.9.1 Hearth thickness.** The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

**2111A.9.2 Hearth extension thickness.** The minimum thickness of hearth extensions shall be 2 inches (51 mm).

**Exception:** When the bottom of the firebox opening is raised at least 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than  $\frac{3}{8}$ -inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

**2111A.10 Hearth extension dimensions.** Hearth extensions shall extend at least 16 inches (406 mm) in front of, and at least 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m<sup>2</sup>) or larger, the hearth extension shall extend at least 20 inches (508 mm) in front of, and at least 12 inches (305 mm) beyond, each side of the fireplace opening.

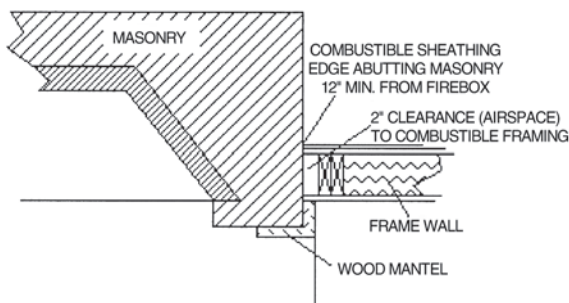
**2111A.11 Fireplace clearance.** Any portion of a masonry fireplace located in the interior of a building or within the



exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The air-space shall not be filled, except to provide fireblocking in accordance with Section 2111A.12.

#### Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and dry-wall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with Figure 2111A.11, provided such combustible trim or sheathing is a minimum of 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than  $\frac{1}{8}$  inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than  $1\frac{1}{2}$  inches (38 mm) from the face of the fireplace shall have an additional clearance equal to the projection.



For SI: 1 inch = 25.4 mm

**FIGURE 2111A.11**  
**ILLUSTRATION OF EXCEPTION TO**  
**FIREPLACE CLEARANCE PROVISIONS**

**2111A.12 Fireplace fireblocking.** All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

**2111A.13 Exterior air.** Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

**2111A.13.1 Factory-built fireplaces.** Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

**2111A.13.2 Masonry fireplaces.** Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

**2111A.13.3 Exterior air intake.** The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within a garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of  $\frac{1}{4}$ -inch (6.4 mm) mesh.

**2111A.13.4 Clearance.** Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

**2111A.13.5 Passageway.** The combustion air passageway shall be a minimum of 6 square inches (3870 mm<sup>2</sup>) and not more than 55 square inches (0.035 m<sup>2</sup>), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

**2111A.13.6 Outlet.** The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

## SECTION 2112A MASONRY HEATERS

**2112A.1 Definition.** A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as "masonry," which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox may include flow in a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.



**2112A.2 Installation.** Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E 1602; or
2. Masonry heaters shall be listed and labeled in accordance with UL 1482 and installed in accordance with the manufacturer's installation instructions.

**2112A.3 Footings and foundation.** The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113.2.

**2112A.4 Seismic reinforcing.** In structures assigned to Seismic Design Category D, E and F, masonry heaters shall be anchored to the masonry foundation in accordance with Section 2113A.3. Seismic reinforcing shall not be required within the body of a masonry heater with a height that is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section 2113A.

**2112A.5 Masonry heater clearance.** Combustible materials shall not be placed within 36 inches (765 mm) of the outside surface of a masonry heater in accordance with NFPA 211, Section 8-7 (clearances for solid fuel-burning appliances), and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

**Exceptions:**

1. When the masonry heater wall thickness is at least 8 inches (203 mm) thick of solid masonry and the wall thickness of the heat exchange channels is at least 5 inches (127 mm) thick of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of at least 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 and installed in accordance with the manufacturer's instructions.

## SECTION 2113A MASONRY CHIMNEYS

**2113A.1 Definition.** A masonry chimney is a chimney constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete, hereinafter referred to as "masonry." Masonry chimneys shall be constructed, anchored, supported and reinforced as required in this chapter.

**2113A.2 Footings and foundations.** Footings for masonry chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 6 inches (152 mm) beyond the face of the foundation or support

wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

**2113A.3 Seismic reinforcing.** Masonry or concrete chimneys shall be constructed, anchored, supported and reinforced as required in this chapter. In structures assigned to Seismic Design Category C or D, masonry and concrete chimneys shall be reinforced and anchored as detailed in Sections 2113A.3.1, 2113A.3.2 and 2113A.4. In structures assigned to Seismic Design Category A or B, reinforcement and seismic anchorage is not required. In structures assigned to Seismic Design Category E or F, masonry and concrete chimneys shall be reinforced in accordance with the requirements of Sections 2101A through 2108A.

**2113A.3.1 Vertical reinforcing.** For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103A.12. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

**2113A.3.2 Horizontal reinforcing.** Vertical reinforcement shall be placed enclosed within  $\frac{1}{4}$ -inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) o.c. in concrete, or placed in the bed joints of unit masonry, at a minimum of every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

**2113A.4 Seismic anchorage.** Masonry and concrete chimneys and foundations in structures assigned to Seismic Design Category C or D shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the following requirements.

**2113A.4.1 Anchorage.** Two  $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25 mm) straps shall be embedded a minimum of 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to a minimum of four floor joists with two  $\frac{1}{2}$ -inch (12.7 mm) bolts.

**2113A.5 Corbeling.** Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

**2113A.6 Changes in dimension.** The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

**2113A.7 Offsets.** Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113A.5.

**2113A.8 Additional load.** Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

**2113A.9 Termination.** Chimneys shall extend at least 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall not be less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

**2113A.9.1 Chimney caps.** Masonry chimneys shall have a concrete, metal or stone cap, sloped to shed water, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C 1283.

**2113A.9.2 Spark arrestors.** *[SFM] All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester. The spark arrester shall meet all of the following requirements:*

1. *The net free area of the spark arrester shall not be less than four times the net free area of the outlet of the chimney flue it serves.*
2. *The spark arrester screen shall have heat and corrosion resistance equivalent to 12-gage wire, 19-gage galvanized wire or 24-gage stainless steel.*
3. *Openings shall not permit the passage of spheres having a diameter larger than  $\frac{1}{2}$  inch (12.7 mm) and shall not block the passage of spheres having a diameter of less than  $\frac{3}{8}$  inch (9.5 mm).*
4. *The spark arrester shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.*

**2113A.9.3 Rain caps.** Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall not be less than four times the net free area of the outlet of the chimney flue it serves.

**2113A.10 Wall thickness.** Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

**2113A.10.1 Masonry veneer chimneys.** Where masonry is used as veneer for a framed chimney, through flashing

and weep holes shall be provided as required by Chapter 14.

**2113A.11 Flue lining (material).** Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

**2113A.11.1 Residential-type appliances (general).** Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C 315.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

**2113A.11.1.1 Flue linings for specific appliances.** Flue linings other than those covered in Section 2113A.11.1 intended for use with specific appliances shall comply with Sections 2113A.11.1.2 through 2113A.11.1.4 and Sections 2113A.11.2 and 2113A.11.3.

**2113A.11.1.2 Gas appliances.** Flue lining systems for gas appliances shall be in accordance with the *International Fuel Gas Code*.

**2113A.11.1.3 Pellet fuel-burning appliances.** Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113A.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113A.11.1.5 for marking).

**2113A.11.1.4 Oil-fired appliances approved for use with L-vent.** Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with Section 2113A.11.1 and listed chimney liners complying with UL 641 (see Section 2113A.11.1.5 for marking).

**2113A.11.1.5 Notice of usage.** When a flue is relined with a material not complying with Section 2113A.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

**2113A.11.2 Concrete and masonry chimneys for medium-heat appliances.**

**2113A.11.2.1 General.** Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113A.1 through 2113A.5.

**2113A.11.2.2 Construction.** Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls a minimum of 8 inches

(203 mm) thick, or with stone masonry a minimum of 12 inches (305 mm) thick.

**2113A.11.2.3 Lining.** Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick a minimum of  $4\frac{1}{2}$  inches (114 mm) thick laid on the  $4\frac{1}{2}$ -inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

**2113A.11.2.4 Multiple passageway.** Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

**2113A.11.2.5 Termination height.** Concrete and masonry chimneys for medium-heat appliances shall extend a minimum of 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

**2113A.11.2.6 Clearance.** A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

### **2113A.11.3 Concrete and masonry chimneys for high-heat appliances.**

**2113A.11.3.1 General.** Concrete and masonry chimneys for high-heat appliances shall comply with Sections 2113A.1 through 2113A.5.

**2113A.11.3.2 Construction.** Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be a minimum of 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

**2113A.11.3.3 Lining.** The inside of the interior wall shall be lined with an approved high-duty refractory brick, a minimum of  $4\frac{1}{2}$  inches (114 mm) thick laid on the  $4\frac{1}{2}$ -inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

**2113A.11.3.4 Termination height.** Concrete and masonry chimneys for high-heat appliances shall extend a minimum of 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

**2113A.11.3.5 Clearance.** Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney and prevent danger of burns to persons.

**2113A.12 Clay flue lining (installation).** Clay flue liners shall be installed in accordance with ASTM C 1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope no greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty nonwatersoluble refractory mortar conforming to ASTM C 199 with tight mortar joints left smooth on the inside and installed to maintain an air space or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

### **2113A.13 Additional requirements.**

**2113A.13.1 Listed materials.** Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

**2113A.13.2 Space around lining.** The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

**Exception:** This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

**2113A.14 Multiple flues.** When two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be at least 4 inches (102 mm) thick and bonded into the walls of the chimney.

**Exception:** When venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered at least 4 inches (102 mm).

**2113A.15 Flue area (appliance).** Chimney flues shall not be smaller in area than the area of the connector from the appliance. Chimney flues connected to more than one appliance shall not be less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

#### **Exceptions:**

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *International Fuel Gas Code*.

**2113A.16 Flue area (masonry fireplace).** Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113A.16.1 or 2113A.16.2.

**2113A.16.1 Minimum area.** Round chimney flues shall have a minimum net cross-sectional area of at least  $\frac{1}{12}$  of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of at least  $\frac{1}{10}$  of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of at least  $\frac{1}{10}$  of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of at least  $\frac{1}{8}$  of the fireplace opening.

**2113A.16.2 Determination of minimum area.** The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113A.16. A flue size providing at least the equivalent net cross-sectional area

shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113A.16(1) and 2113A.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the fire-box floor to the top of the chimney flue.

**TABLE 2113A.16(1)  
NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES<sup>a</sup>**

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10 <sup>3</sup> / <sub>4</sub>	90
12	113
15	176
18	254

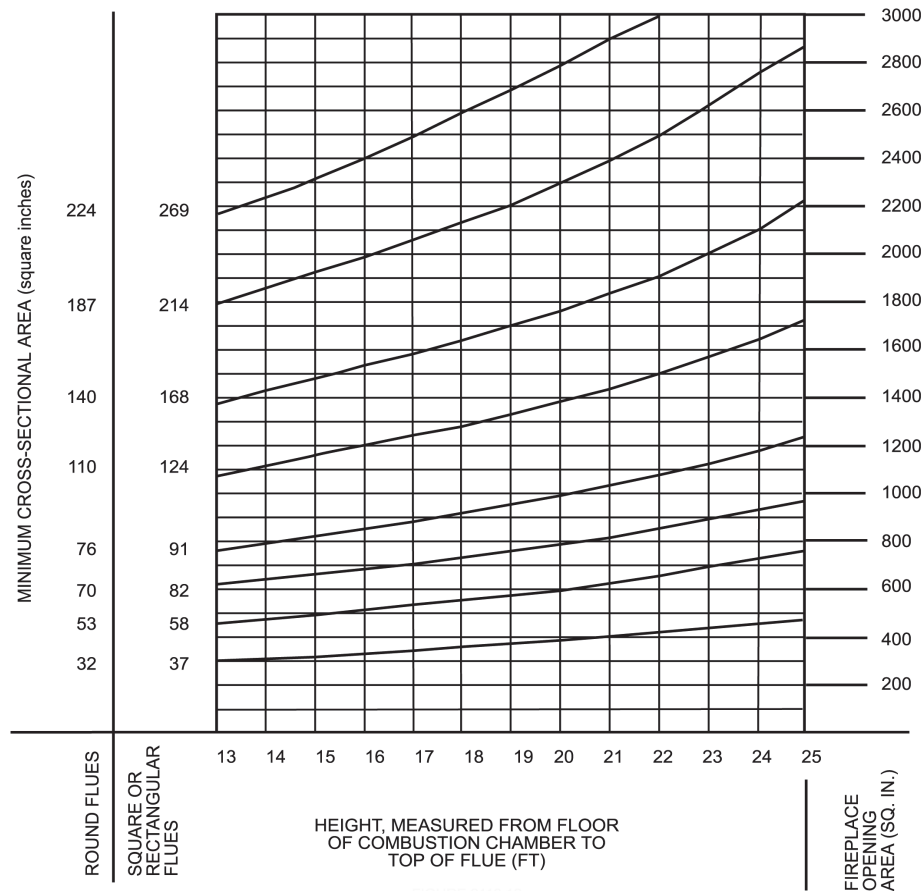
For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.

a. Flue sizes are based on ASTM C 315.

**TABLE 2113A.16(2)  
NET CROSS-SECTIONAL AREA OF SQUARE AND  
RECTANGULAR FLUE SIZES<sup>a</sup>**

FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 × 13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.



For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm<sup>2</sup>.

**FIGURE 2113A.16  
FLUE SIZES FOR MASONRY CHIMNEYS**

**2113A.17 Inlet.** Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

**2113A.18 Masonry chimney cleanout openings.** Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located at least 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be at least 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

**Exception:** Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

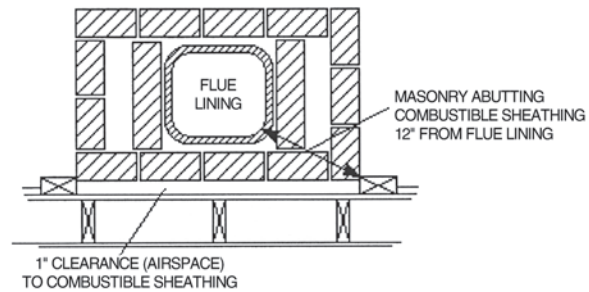
**2113A.19 Chimney clearances.** Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113A.20.

**Exceptions:**

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113A.19, provided such combustible trim or sheathing is a minimum of 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).

**2113A.20 Chimney fireblocking** All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be self-supporting or to a depth of 1 inch (25 mm) and shall only be placed on strips of metal

or metal lath laid across the spaces between combustible material and the chimney.



For SI: 1 inch = 25.4 mm.

**FIGURE 2113A.19  
ILLUSTRATION OF EXCEPTION THREE  
CHIMNEY CLEARANCE PROVISIONS**

**SECTION 2114A  
NONBEARING WALLS**

**2114A.1 General.** All nonbearing masonry walls shall be reinforced as specified in Section 2106A.1.1.1. Fences and interior nonbearing nonshear walls may be of hollow-unit masonry construction grouted in cells containing vertical and horizontal reinforcement. Nonbearing walls may be used to carry a superimposed load of not more than 200 pounds per linear foot (2.92 kN/m).

1. **Thickness.** Every nonbearing masonry wall shall be so constructed and have a sufficient thickness to withstand all vertical loads and horizontal loads, but in no case shall the thickness of such walls be less than the values set forth in Table 2107A.5.

Plaster shall not be considered as contributing to the thickness of a wall in computing the height-to-thickness ratio.

2. **Anchorage.** All nonbearing walls shall be anchored as required by Section 1604A.8.2 and ASCE 7 Chapter 13. Suspended ceilings or other nonstructural elements shall not be used to provide anchorage for masonry walls.

**SECTION 2115A  
MASONRY SCREEN WALLS**

**2115A.1 General.** Masonry units may be used in nonbearing decorative screen walls. Units may be laid up in panels with units on edge with the open pattern of the unit exposed in the completed wall.

1. **Horizontal forces.** The panels shall be capable of spanning between supports to resist the horizontal forces

specified in Chapter 16A. Wind loads shall be based on the gross projected area of the block.

2. **Mortar joints.** Horizontal and vertical joints shall not be less than  $\frac{1}{4}$  inch (6 mm) thick. All joints shall be completely filled with mortar and shall be "shoved joint" work. The units of a panel shall be so arranged that either the horizontal or the vertical joint containing reinforcing is continuous without offset. This continuous joint shall be reinforced with a minimum of 0.03 square inch (19 mm<sup>2</sup>) of reinforcing steel and maximum spacing of 16 inches on center. Reinforcement may be embedded in mortar.
3. **Reinforcement.** Joint reinforcement may be composed of two wires made with welded ladder or trussed wire cross ties. In calculating the resisting capacity of the system, compression and tension in the spaced wires may be utilized. Ladder wire reinforcement shall not be spliced and shall be the widest that the mortar joint will accommodate, allowing  $\frac{1}{2}$  inch (13 mm) of mortar cover.
4. **Size of panels.** The maximum size of panels shall be 144 square feet (13.4 m<sup>2</sup>), with the maximum dimension in either direction of 15 feet (4572 mm). The specified thickness of the units for exterior applications shall not be less than  $3\frac{7}{8}$  inches.
5. **Panel support.** Each panel shall be supported on all edges by a structural member of concrete, masonry or steel. Supports at the top and ends of the panel shall be by means of confinement of the masonry by at least 1 inch (25 mm) into and between the flanges of a steel channel. The space between the end of the panel and the web of the channel shall be filled with resilient material. The use of an equivalent configuration in other steel sections or in masonry or concrete is acceptable.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 22 – STEEL

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X		X	X						X	X									
<i>Adopt entire chapter as amended (amended sections listed below)</i>								X												
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
2201.1.1								X												
2201.1.2								X												
2201.1.3								X												
2201.1.4								X												
2212								X												
2212.1								X												
2212.1.1								X												
2212.2								X												
2212.3								X												
2212.4								X												
2212.5								X												
2212.6								X												





## CHAPTER 22

# STEEL

### SECTION 2201 GENERAL

**2201.1 Scope.** The provisions of this chapter govern the quality, design, fabrication and erection of steel used structurally in buildings or structures.

**2201.1.1 Application.** [DSA-SS/CC] *The scope of application of Chapter 22 is as follows:*

*Community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), as listed in Section 1.9.2.2.*

**2201.1.2 Identification of amendments.** [DSA-SS/CC]

*Division of the State Architect-Structural Safety/Community Colleges amendments appear in this chapter preceded with the appropriate acronym, as follows:*

**[DSA-SS/CC]** - *For community college buildings listed in Section 1.9.2.2*

**2201.1.3 Reference to other chapters.** [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapter 17 the provisions in Chapter 17A, shall apply instead.*

**2201.1.4 Amendments.** [DSA-SS/CC] *See Section 2212 for additional requirements.*

### SECTION 2202 DEFINITIONS

**2202.1 Definitions.** The following terms are defined in Chapter 2:

**STEEL CONSTRUCTION, COLD-FORMED.**

**STEEL JOIST.**

**STEEL MEMBER, STRUCTURAL.**

### SECTION 2203 IDENTIFICATION AND PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

**2203.1 Identification.** Identification of structural steel members shall comply with the requirements contained in AISC 360. Identification of cold-formed steel members shall comply with the requirements contained in AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Steel that is not readily identifiable as to grade from marking and test records shall be tested to determine conformity to such standards.

**2203.2 Protection.** Painting of structural steel members shall comply with the requirements contained in AISC 360. Paint-

ing of open-web steel joists and joist girders shall comply with the requirements of SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 and SJI LH/DLH-1.1. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200.

### SECTION 2204 CONNECTIONS

**2204.1 Welding.** The details of design, workmanship and technique for welding, inspection of welding and qualification of welding operators shall conform to the requirements of the specifications listed in Sections 2205, 2206, 2207, 2208, 2210 and 2211. Special inspection of welding shall be provided where required by Section 1705.

**2204.2 Bolting.** The design, installation and inspection of bolts shall be in accordance with the requirements of the specifications listed in Sections 2205, 2206, 2207, 2210 and 2211. Special inspection of the installation of high-strength bolts shall be provided where required by Section 1705.

**2204.2.1 Anchor rods.** Anchor rods shall be set in accordance with the construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.

### SECTION 2205 STRUCTURAL STEEL

**2205.1 General.** The design, fabrication and erection of structural steel for buildings and structures shall be in accordance with AISC 360. Where required, the seismic design of structural steel structures shall be in accordance with the additional provisions of Section 2205.2.

**2205.2 Seismic requirements for structural steel structures.** The design of structural steel structures to resist seismic forces shall be in accordance with the provisions of Section 2205.2.1 or 2205.2.2, as applicable.

**2205.2.1 Seismic Design Category B or C.** Structural steel structures assigned to Seismic Design Category B or C shall be of any construction permitted in Section 2205. Where a response modification coefficient,  $R$ , in accordance with ASCE 7, Table 12.2-1 is used for the design of structural steel structures assigned to Seismic Design Category B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

**Exception:** The response modification coefficient,  $R$ , designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column sys-

tems” in ASCE 7, Table 12.2-1 shall be permitted for systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

**2205.2.2 Seismic Design Category D, E or F.** Structural steel structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1.

## SECTION 2206 COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

**2206.1 General.** Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 22. Where required, the seismic design of composite steel and concrete systems shall be in accordance with the additional provisions of Section 2206.2.

**2206.2 Seismic requirements for composite structural steel and concrete construction.** Where a response modification coefficient,  $R$ , in accordance with ASCE 7, Table 12.2-1 is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

## SECTION 2207 STEEL JOISTS

**2207.1 General.** The design, manufacture and use of open web steel joists and joist girders shall be in accordance with one of the following Steel Joist Institute (SJI) specifications:

1. SJI CJ-1.0
2. SJI K-1.1
3. SJI LH/DLH-1.1
4. SJI JG-1.1

Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205.2 or 2211.6.

**2207.2 Design.** The registered design professional shall indicate on the construction documents the steel joist and/or steel joist girder designations from the specifications listed in Section 2207.1 and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, non-SJI standard bridging, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
  - 1.1. Concentrated loads;
  - 1.2. Nonuniform loads;
  - 1.3. Net uplift loads;
  - 1.4. Axial loads;
  - 1.5. End moments; and
- 1.6. Connection forces.
2. Special considerations including:
  - 2.1. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog);
  - 2.2. Oversized or other nonstandard web openings; and
  - 2.3. Extended ends.
3. Deflection criteria for live and total loads for non-SJI standard joists.

**2207.3 Calculations.** The steel joist and joist girder manufacturer shall design the steel joists and/or steel joist girders in accordance with the current SJI specifications and load tables to support the load requirements of Section 2207.2. The registered design professional may require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. If requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

1. Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.).
2. Connection details for:
  - 2.1. Non-SJI standard connections (e.g. flush-framed or framed connections);
  - 2.2. Field splices; and
  - 2.3. Joist headers.

**2207.4 Steel joist drawings.** Steel joist placement plans shall be provided to show the steel joist products as specified on the construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207.2. Steel placement plans shall include, at a minimum, the following:

1. Listing of all applicable loads as stated in Section 2207.2 and used in the design of the steel joists and joist girders as specified in the construction documents.
2. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog).
3. Connection requirements for:
  - 3.1. Joist supports;
  - 3.2. Joist girder supports;
  - 3.3. Field splices; and
  - 3.4. Bridging attachments.
4. Deflection criteria for live and total loads for non-SJI standard joists.
5. Size, location and connections for all bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional.

**2207.5 Certification.** At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance in accordance with Section 1704.2.5.2 stating that work was performed in accordance with approved construction documents and with SJI standard specifications.

## SECTION 2208 STEEL CABLE STRUCTURES

**2208.1 General.** The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

**2208.2 Seismic requirements for steel cable.** The design strength of steel cables shall be determined by the provisions of ASCE 19 except as modified by these provisions.

1. A load factor of 1.1 shall be applied to the prestress force included in  $T_3$  and  $T_4$  as defined in Section 3.12.
2. In Section 3.2.1, Item (c) shall be replaced with "1.5  $T_3$ " and Item (d) shall be replaced with "1.5  $T_4$ ."

## SECTION 2209 STEEL STORAGE RACKS

**2209.1 Storage racks.** The design, testing and utilization of industrial steel storage racks made of cold-formed or hot-rolled steel structural members, shall be in accordance with RMI/ANSI MH 16.1. Where required by ASCE 7, the seismic design of storage racks shall be in accordance with the provisions of Section 15.5.3 of ASCE 7, except that the mapped acceleration parameters,  $S_s$  and  $S_I$ , shall be determined in accordance with Section 1613.3.1.

## SECTION 2210 COLD-FORMED STEEL

**2210.1 General.** The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-frame construction shall also comply with Section 2211. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210.2.

**2210.1.1 Steel decks.** The design and construction of cold-formed steel decks shall be in accordance with this section.

**2210.1.1.1 Noncomposite steel floor decks.** Noncomposite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

**2210.1.1.2 Steel roof deck.** Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0.

**2210.2 Seismic requirements for cold-formed steel structures.** Where a response modification coefficient,  $R$ , in accordance with ASCE 7, Table 12.2-1 is used for the design of

cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100, ASCE 8, and, for cold-formed steel special-bolted moment frames, AISI S110.

## SECTION 2211 COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

**2211.1 General.** The design and installation of structural members and nonstructural members utilized in cold-formed steel light-frame construction where the specified minimum base steel thickness is between 0.0179 inches (0.455 mm) and 0.1180 inches (2.997 mm) shall be in accordance with AISI S200 and Sections 2211.2 through 2211.7, as applicable.

**2211.2 Header design.** Headers, including box and back-to-back headers, and double and single L-headers shall be designed in accordance with AISI S212 or AISI S100.

**2211.3 Truss design.** Cold-formed steel trusses shall be designed in accordance with AISI S214, Sections 2211.3.1 through 2211.3.4 and accepted engineering practice.

**2211.3.1 Truss design drawings.** The truss design drawings shall conform to the requirements of Section B2.3 of AISI S214 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section B6(a) or B 6(c) of AISI S214 where these methods are utilized to provide restraint/bracing.

**2211.3.2 Deferred submittals.** AISI S214 Section B4.2 shall be deleted.

**2211.3.3 Trusses spanning 60 feet or greater.** The owner shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall conform to Section 1705.

**2211.3.4 Truss quality assurance.** Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency, shall be manufactured in compliance with Sections 1704.2.5 and 1705.2, as applicable.

**2211.4 Wall stud design.** Wall studs shall be designed in accordance with either AISI S211 or AISI S100.

**2211.5 Floor and roof system design.** Framing for floor and roof systems in buildings shall be designed in accordance with either AISI S210 or AISI S100.

**2211.6 Lateral design.** Light-frame shear walls, diagonal strap bracing that is part of a structural wall and diaphragms used to resist wind, seismic and other in-plane lateral loads shall be designed in accordance with AISI S213.

**2211.7 Prescriptive framing.** Detached one- and two-family dwellings and townhouses, less than or equal to three stories above grade plane, shall be permitted to be constructed in accordance with AISI S230 subject to the limitations therein.

## SECTION 2212 ADDITIONAL REQUIREMENTS [DSA-SS/CC]

### 2212.1 Connections.

**2212.1.1 Column base plate.** When shear and/or tensile forces are intended to be transferred between column base plates and anchor bolts, provision shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than  $\frac{1}{8}$  inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.

### 2212.2 Modifications to AISC 341.

**2212.2.1 Section D1.** Add Section D1.6 as follows:

**6. Diaphragm bracing systems.** The required strength of diagonal bracing members used as the diaphragm shall be determined from either of the following:

- (1) The load effect resulting from the diaphragm analysis per the applicable building code provided the members satisfy all of the following requirements:
  1. Diagonal bracing members comply with Section D1.1 for moderately ductile members.
  2. Each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance.
  3. Diagonal bracing members shall not support gravity loads other than self-weight.
- (2) The load effect required for collectors using the load combinations stipulated in the applicable building code.

**2212.2.2 Section D2.** Modify Section D2.6c(b)(ii) as follows:

- (ii) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

**2212.2.3 Section D2.** Add Section D2.9 as follows:

**9. Diaphragm bracing systems.** The required strength of the connections of diagonal bracing members used as the diaphragm shall be the load effect required for collectors using the load combinations stipulated in the applicable building code.

**2212.2.4 Section F2.** Modify Section F2.3 Exception (2)(a) as follows:

- (a) The maximum of the forces determined using load combination stipulated by the applicable building code including the amplified seismic load, applied to the building frame model in which all compression

braces have been removed and those determined with no compression braces removed per D1.4a(2).

**2212.2.5 Section F2.** Modify Section F2.4a by adding the following:

Where each framing bay on a line of resistance does not have opposing diagonal braces within the same column bay, then the collector forces along that line shall be designed considering the redistribution of seismic forces to other bays as a result of the post buckled redistribution of loads using the analysis requirements of Section F2.3. The collector shall not be designed for a load less than that stipulated by the applicable building code:

**2212.3 Seismic requirements for composite structural steel and concrete construction.** In addition to the requirements of Section 2206.2, steel and concrete composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted provided:

1. Beams are provided with reduced beam sections (RBS),
2. Columns shall be hollow structural sections (HSS) and completely filled with structural concrete having unit weight not less than 110 pounds per cubic foot (17 kN/m<sup>3</sup>). Concrete shall have 28-day compressive strength not less than 4,000 psi (28 MPa).
3. Web extension to beam web two sided fillet weld welds are sized to develop expected strength of the beam web and shall not be less than a  $\frac{1}{4}$  inch fillet weld,
4. The high strength bolt design shall consider interaction between shear and tension as required by AISC 360, and
5. The HSS shall not be less than  $\frac{1}{2}$  inch.

### 2212.4 Steel joists.

**2212.4.1 Design approval.** Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with Title 24, Part 1. Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.

**2212.4.2 Joist chord bracing.** The chords of all joists shall be laterally supported at all points where the chords change direction.

### 2212.5 Cold-formed steel light-frame construction.

#### 2212.5.1 Trusses.

**2212.5.1.1 Analysis submittals.** Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required the test report shall be submitted with the

*truss design drawings and engineering analysis to the enforcement agency.*

**2212.5.1.2 Deferred submittals.** *AISI S214 Section B4.2 shall not be deleted.*

**2212.5.2 Anchorage for shear.** *Cold formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*

**2212.5.3 Limitations on shear wall assemblies.** *Shear wall assemblies per Section C2.2.3 of AISI- S213 are not permitted within the seismic force-resisting system of buildings or structures assigned to Occupancy Category II, III, IV., or buildings designed to be relocatable.*

## **2212.6 Testing.**

**2212.6.1 Tests of high-strength bolts, nuts and washers.** *High-strength bolts, nuts and washers shall be sampled and tested by an approved independent testing laboratory for conformance with the requirements of Section 2205.*

**2212.6.2 Tests of end-welded studs.** *End-welded studs shall be sampled and tested per the requirements of the AWS D1.1.*



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 22A – STEEL

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>							X		X			X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				





## CHAPTER 22A

# STEEL

### SECTION 2201A GENERAL

**2201A.1 Scope.** The provisions of this chapter govern the quality, design, fabrication and erection of steel used structurally in buildings or structures.

**2201A.1.1 Application.** *The scope of application of Chapter 22A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1, and 1.10.4. These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.*

**Exception:** [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 22 and any applicable amendments therein.*

**2201A.1.2 Identification of amendments.** *DSA-SS and OSHPD adopt this chapter and all amendments.*

**Exception:** *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety: [DSA-SS] For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Health Planning and Development: [OSHPD 1] - For applications listed in Section 1.10.1.  
[OSHPD 4] - For applications listed in Section 1.10.4*

### SECTION 2202A DEFINITIONS

**2202A.1 Definitions.** *The following terms are defined in Chapter 2.*

**STEEL CONSTRUCTION, COLD-FORMED.**

**STEEL JOIST.**

**STEEL MEMBER, STRUCTURAL.**

### SECTION 2203A IDENTIFICATION AND PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

**2203A.1 Identification.** Identification of structural steel members shall comply with the requirements contained in AISC 360. Identification of cold-formed steel members shall comply with the requirements contained in AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Steel that is not readily identifiable as to grade from marking and test records shall be tested to determine conformity to such standards.

**2203A.2 Protection.** Painting of structural steel members shall comply with the requirements contained in AISC 360. Painting of open-web steel joists and joist girders shall comply with the requirements of SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 and SJI LH/DLH-1.1. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200.

### SECTION 2204A CONNECTIONS

**2204A.1 Welding.** The details of design, workmanship and technique for welding, inspection of welding and qualification of welding operators shall conform to the requirements of the specifications listed in Sections 2205A, 2206A, 2207A, 2208A, 2210A and 2211A. Special inspection of welding shall be provided where required by Section 1705A.

**2204A.2 Bolting.** The design, installation and inspection of bolts shall be in accordance with the requirements of the specifications listed in Sections 2205A, 2206A, 2207A, 2210A and 2211A. Special inspection of the installation of high-strength bolts shall be provided where required by Section 1705A.

**2204A.2.1 Anchor rods.** Anchor rods shall be set in accordance with the construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.

**2204A.2.2 Column base plate.** *When shear and/or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs and/or welded shear transfer plates or other means acceptable to*

the enforcement agency, when the oversized holes are larger than the anchor bolt by more than  $\frac{1}{8}$  inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.

## SECTION 2205A STRUCTURAL STEEL

**2205A.1 General.** The design, fabrication and erection of structural steel for buildings and structures shall be in accordance with AISC 360. Where required, the seismic design of structural steel structures shall be in accordance with the additional provisions of Section 2205A.2.

**2205A.2 Seismic requirements for structural steel structures.** The design of structural steel structures to resist seismic forces shall be in accordance with the provisions of Section 2205A.2.2, as applicable.

**2205A.2.1 Seismic Design Category A, B or C.** Not permitted by DSA-SS and OSHPD.

**2205A.2.2 Seismic Design Category D, E or F.** Structural steel structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341.

### 2205A.3 Modifications to AISC 341. [DSA-SS]

**2205A.3.1 Section D1.** Add Section D1.6 as follows:

**6. Diaphragm bracing systems.** The required strength of diagonal bracing members used as the diaphragm shall be determined from either of the following:

- (1) The load effect resulting from the diaphragm analysis per the applicable building code provided the members satisfy all of the following requirements:
  1. Diagonal bracing members comply with Section D1.1 for moderately ductile members.
  2. Each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance.
  3. Diagonal bracing members shall not support gravity loads other than self-weight.
- (2) The load effect required for collectors using the load combinations stipulated in the applicable building code.

**2205A.3.2 Section D2.** Modify Section D2.6c(b)(ii) as follows:

(ii) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

**2205A.3.3 Section D2.** Add Section D2.9 as follows:

**9. Diaphragm bracing systems.** The required strength of the connections of diagonal bracing members used

as the diaphragm shall be the load effect required for collectors using the load combinations stipulated in the applicable building code.

**2205A.3.4 Section F2.** Modify Section F2.3 Exception (2)(a) as follows:

(a) The maximum of the forces determined using load combination stipulated by the applicable building code including the amplified seismic load, applied to the building frame model in which all compression braces have been removed and those determined with no compression braces removed per D1.4a(2).

**2205A.3.5 Section F2.** Modify Section F2.4a by adding the following:

Where each framing bay on a line of resistance does not have opposing diagonal braces within the same column bay, then the collector forces along that line shall be designed considering the redistribution of seismic forces to other bays as a result of the post-buckled redistribution of loads using the analysis requirements of Section F2.3. The collector shall not be designed for a load less than that stipulated by the applicable building code.

### 2205A.4 Modifications to AISC 341. [OSHPD 1 and 4]

**2205A.4.1 Glossary.** Modify glossary by adding the following:

**Inelastic Rotation:** The permanent or plastic portion of the rotation angle between a beam and the column, or between a link and the column of the test specimen, measured in radians. The inelastic rotation shall be computed based upon an analysis of the test specimen deformations. Sources of inelastic rotation include yielding of members and connectors, yielding of connection elements and slip between members and connection elements. For beam-to-column moment connections in special moment frames, the inelastic rotation is represented by the plastic chord rotation angle calculated as the plastic deflection of the beam or girder, at the center of its span divided by the distance between the center of the beam span and the centerline of the panel zone of the beam-column connection. For link-to-column connections in eccentrically braced frames, inelastic rotation shall be computed based upon the assumption that inelastic action is concentrated at a single point located at the intersection of the centerline of the link with the face of the column.

**2205A.4.2 Section E3.** Replace Section E3.6b Item 1 by the following:

- (1) The connection shall be capable of sustaining an interstory drift angle of at least 0.04 radians and an inelastic rotation of 0.03 radians.

**2205A.4.3 Section E3.** Replace Section E3.6c Item # a by the following:

- (a) Use of SMF connections designed in accordance with ANSI/AISC 358 shall be as modified in Section 2205A.4.

**2205A.4.4 Section F2.** Special concentrically braced frames (SCBF) modifications

5b. Diagonal braces, Add a new section as follows.

- (4) The use of rectangular or square HSS are not permitted for bracing members, unless filled solid with cement grout having a minimum compressive strength of 3000 psi at 28 days. The effects of composite action in the filled composite brace shall be considered in the sectional properties of the system where it results in the more severe loading condition or detailing.

**2205A.4.5 Section F3.** Modify Section F3.6e Item 2 as follows:

*Exception is not permitted.*

**2205A.4.6 Section F3.** Replace Section K2.3b as follows:

*The size of the beam or link used in the test specimen shall be within the following limits:*

1. At least one of the test beams or links shall be no less than 100 percent of the depth of the prototype beam or link. For the remaining specimens, the depth of the test beam or link shall be no less than 90 percent of the depth of the prototype beam or link.
2. At least one of the test beams or links shall be no less than 100 percent of the weight per foot of the prototype beam or link. For the remaining specimens, the weight per foot of the test beam or link shall be no less than 75 percent of the weight per foot of the prototype beam or link.

*The size of the column used in the test specimen shall properly represent the inelastic action in the column, as per the requirements in Section K2.3a. In addition, the depth of the test column shall be no less than 90 percent of the depth of the prototype column.*

*Extrapolation beyond the limitations stated in this section shall be permitted subject to peer review and approval by the enforcement agency.*

**2205A.4.7 Section F3.** Modify Section K2.8 by the following:

*The test specimen must sustain the required interstory drift angle, or link rotation angle, and inelastic rotation for at least two complete loading cycles.*

#### **2205A.5 Modifications to AISC 358. [OSHPD 1 and 4]**

**2205A.5.1.2. Design Requirements, 2.1 Special and Intermediate Moment Frame Connection Types, Table 2-1 Prequalified Moment Connections modifications.**

*The prequalified bolted moment connections are not permitted in buildings.*

#### **Exceptions:**

1. Erection bolts are permitted.
2. The approved moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206A.2.

## **SECTION 2206A COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES**

**2206A.1 General.** Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 22. Where required, the seismic design of composite steel and concrete systems shall be in accordance with the additional provisions of Section 2206A.2.

**2206A.2 Seismic requirements for composite structural steel and concrete construction.** Where a response modification coefficient,  $R$ , in accordance with ASCE 7, Table 12.2-1 is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341 and shall be considered as an alternative system.

**Exception:** Steel and concrete composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted, provided:

1. Beams are provided with reduced beam sections (RBS),
2. Columns shall be hollow structural sections (HSS) and completely filled with structural concrete having unit weight not less than 110 pounds per cubic foot (17 kN/m<sup>3</sup>). Concrete shall have 28-day compressive strength not less than 4,000 psi (28 MPa).
3. Web extension to beam web two sided fillet weld welds are sized to develop expected strength of the beam web and shall not be less than a  $\frac{1}{4}$  inch fillet weld,
4. The high-strength bolt design shall consider interaction between shear and tension as required by AISC 360, and
5. The HSS shall not be less than  $\frac{1}{2}$  inch.

## **SECTION 2207A STEEL JOISTS**

**2207A.1 General.** The design, manufacture and use of open web steel joists and joist girders shall be in accordance with one of the following Steel Joist Institute (SJI) specifications:

1. SJI CJ-1.0
2. SJI K-1.1
3. SJI LH/DLH-1.1
4. SJI JG-1.1

Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205A.2 or 2210A.5.

**2207A.2 Design.** The registered design professional shall indicate on the construction documents the steel joist and/or

steel joist girder designations from the specifications listed in Section 2207A.1 and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, non-SJI standard bridging, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
  - 1.1. Concentrated loads;
  - 1.2. Nonuniform loads;
  - 1.3. Net uplift loads;
  - 1.4. Axial loads;
  - 1.5. End moments; and
  - 1.6. Connection forces.
2. Special considerations including:
  - 2.1. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog);
  - 2.2. Oversized or other nonstandard web openings; and
  - 2.3. Extended ends.
3. Deflection criteria for live and total loads for non-SJI standard joists.

**2207A.3 Calculations.** The steel joist and joist girder manufacturer shall design the steel joists and/or steel joist girders in accordance with the current SJI specifications and load tables to support the load requirements of Section 2207A.2. The registered design professional may require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. If requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

1. Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.).
2. Connection details for:
  - 2.1. Non-SJI standard connections (e.g. flush-framed or framed connections);
  - 2.2. Field splices; and
  - 2.3. Joist headers.

**2207A.4 Steel joist drawings.** Steel joist placement plans shall be provided to show the steel joist products as specified on the construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207A.2. Steel placement plans shall include, at a minimum, the following:

1. Listing of all applicable loads as stated in Section 2207A.2 and used in the design of the steel joists and joist girders as specified in the construction documents.

2. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog).
3. Connection requirements for:
  - 3.1. Joist supports;
  - 3.2. Joist girder supports;
  - 3.3. Field splices; and
  - 3.4. Bridging attachments.
4. Deflection criteria for live and total loads for non-SJI standard joists.
5. Size, location and connections for all bridging.
6. Joist headers. <

**2207A.4.1 Design approval.** [DSA-SS] Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.

**2207A.5 Certification.** At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance in accordance with Section 1704A.2.2 stating that work was performed in accordance with approved construction documents and with SJI standard specifications.

**2207A.6 Joist chord bracing.** The chords of all joists shall be laterally supported at all points where the chords change direction.

## SECTION 2208A STEEL CABLE STRUCTURES

**2208A.1 General.** The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19. <

## SECTION 2209A STEEL STORAGE RACKS

**2209A.1 Storage racks.** The design, testing and utilization of industrial steel storage racks made of cold-formed or hot-rolled steel structural members, shall be in accordance with RMI/ANSI MH 16.1. Where required by ASCE 7, the seismic design of storage racks shall be in accordance with the provisions of Section 15.5.3 of ASCE 7, except that the mapped acceleration parameters,  $S_s$  and  $S_1$ , shall be determined in accordance with Section 1613A.3.1.

## SECTION 2210A COLD-FORMED STEEL

**2210A.1 General.** The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-frame construction shall also comply with Section 2211A. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210A.2.

**2210A.1.1 Steel decks.** The design and construction of cold-formed steel decks shall be in accordance with this section.

**2210A.1.1.1 Noncomposite steel floor decks.** Non-composite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

**2210A.1.1.2 Steel roof deck.** Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0. *The base material thickness of steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

***Exception:** [DSA-SS] For single-story open structures, the minimum deck thickness may be waived if the steel roof deck need not be used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

**2210A.1.1.3 Composite slabs on steel decks.** Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with ANSI/SDI-C.

**2210A.2 Seismic requirements for cold-formed steel structures.** Where a response modification coefficient,  $R$ , in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100 and ASCE 8.

## SECTION 2211A COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

**2211A.1 General.** The design and installation of structural members and nonstructural members utilized in cold-formed steel light-frame construction where the specified minimum base steel thickness is between 0.0179 inches (0.455 mm) and 0.1180 inches (2.997 mm) shall be in accordance with AISI S200 and Sections 2211A.2 through 2211A.7, as applicable.

**2211A.2 Header design.** Headers, including box and back-to-back headers, and double and single L-headers shall be designed in accordance with AISI S212 or AISI S100.

**2211A.3 Truss design.** Cold-formed steel trusses shall be designed in accordance with AISI S214, Sections 2211A.3.1 through 2211A.3.4 and accepted engineering practice.

*Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required, the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.*

**2211A.3.1 Truss design drawings.** The truss design drawings shall conform to the requirements of Section B2.3 of AISI S214 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section B of AISI S214 where these methods are utilized to provide restraint/bracing.

**2211A.3.2 Deferred submittals.** *Not permitted by DSA-SS and OSHPD.*

**2211A.3.3 Trusses spanning 60 feet or greater.** The owner shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall conform to Section 1705A.

**2211A.3.4 Truss quality assurance.** Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency, shall be manufactured in compliance with Sections 1704A.2.5 and 1705A.3, as applicable.

**2211A.4 Wall stud design.** Wall studs shall be designed in accordance with either AISI S211 or AISI S100.

*Cold formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*

**2211A.5 Floor and roof system design.** Framing for floor and roof systems in buildings shall be designed in accordance with either AISI S210 or AISI S100.

**2211A.6 Lateral design.** Light-frame shear walls, diagonal strap bracing that is part of a structural wall and diaphragms used to resist wind, seismic and other in-plane lateral loads shall be designed in accordance with AISI S213.

*Shear wall assemblies per Section C2.2.3 of AISI-S213 are not permitted within the seismic force-resisting system of buildings.*

**2211A.7 Prescriptive framing.** *Not permitted by DSA-SS and OSHPD.*

## SECTION 2212A [DSA-SS] LIGHT MODULAR STEEL MOMENT FRAMES FOR PUBLIC ELEMENTARY AND SECONDARY SCHOOLS, AND COMMUNITY COLLEGES

**2212A.1 General.**

**2212A.1.1 Configuration.** *Light modular steel moment frame buildings shall be constructed of factory-assembled modules comprising a single-story moment-resisting space frame supporting a floor and roof. Individual modules*

shall not exceed a width of 14 feet (4.25 m) nor a length of 72 feet (22 m). All connections of beams to corner columns shall be designed as moment-resisting in accordance with the criteria of Section 2212A.2. Modules may be stacked to form multistory structures not exceeding 35 feet or two stories in height. When stacked modules are evaluated separately, seismic forces on each module shall be distributed in accordance with Section 12.8.3 of ASCE 7, considering the modules in the stacked condition. See Section 2212A.2.5 of this code.

**2212A.1.2 Design, fabrication and erection.** The design, fabrication and erection of light modular steel moment-frame buildings shall be in accordance with the AISC Specification for Structural Steel Buildings (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold Formed Structural Members (AISI/COS/NASPEC), as applicable, and the requirements of this section. The maximum dead load of the roof and elevated floor shall not exceed 25 psf and 50 psf (1197 Pa and 2394 Pa), respectively. The maximum dead load of the exterior walls shall not exceed 45 psf (2155 Pa).

**2212A.2 Seismic requirements.** In addition to the other requirements of this code, the design, materials and workmanship of light modular steel moment frames shall comply with the requirements of this section. The response modification coefficient  $R$  shall be equal to  $3^{1/2}$ .  $C_d$  and  $\Omega_0$  shall be equal to 3.0.

**2212A.2.1 Base materials.** Beams, columns and connection materials shall be limited to those materials permitted under the AISC Specification for Structural Members (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold Formed Structural Members (AISI/COS/NASPEC).

**2212A.2.2 Beam-to-column strength ratio.** At each moment-resisting connection the following shall apply:

$$\frac{\sum S_{bi} F_{ybi}}{\sum S_{cj} F_{ycj}} \geq 1.4 \quad (\text{Equation 22A-1})$$

where:

$F_{ybi}$  = The specified yield stress of beam “i.”

$F_{ycj}$  = The specified yield stress of column “j.”

$S_{bi}$  = The flexural section modulus of each beam “i” that is moment connected to the column “j” at the connection.

$S_{cj}$  = The flexural section modulus of each column “j” that is moment connected to the beam “i” at the connection.

**Exceptions:**

1. Beam-to-column connections at the floor level beams of first or second-story modules need not comply with this requirement.
2. Beam-to-column strength ratios less than 1.4 are allowed if proven to be acceptable by analysis or testing.

**2212A.2.3 Welding.** Weld filler metals shall be capable of producing weld metal with a minimum Charpy V-Notch toughness of 20 ft-lb at 0°F. Where beam bottom flanges attach to columns with complete joint penetration groove welds and weld backing is used at the bottom surface of the beam flange, such backing shall be removed and the root pass back-gouged, repaired and reinforced with a minimum  $3/16$  inch (5 mm) fillet weld.

**2212A.2.4 Connection design.** Connections of beams to columns shall have the design strength to resist the maximum seismic load effect,  $E_m$ , calculated in accordance with Section 12.4.3 of ASCE 7.

**2212A.2.5 Multistory assemblies.** Analysis of multistory assemblies shall be permitted to consider the stacked modules as a single assembly, with restraint conditions between the stacked units that represent the actual method of attachment. Alternatively, it shall be permitted to analyze the individual modules of stacked assemblies independently, with lateral and vertical reactions from modules above applied as concentrated loads at the top of the supporting module.

## SECTION 2213A TESTING AND FIELD VERIFICATION

**2213A.1 Tests of high-strength bolts, nuts and washers.** High-strength bolts, nuts and washers shall be sampled and tested by an approved independent testing laboratory for conformance with the requirements of applicable ASTM standards.

**[OSHPD 1 and 4]** A minimum of three samples per lot, as defined in the ASTM standards for bolts [and not nuts and washers], shall be tested for tensile properties, but need not exceed three samples per 400 bolts.

**2213A.2 Tests of end-welded studs.** End-welded studs shall be tested per the requirements of the AWS D1.1, Sections 7.7 and 7.8.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 23 – WOOD

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter											X									
Adopt entire chapter as amended (amended sections listed below)	X		X	X			X	X	X	X		X								
Adopt only those sections that are listed below		X																X		
Chapter / Section																				
2301.1			X	X																
2301.1.1							X	X	X	X		X								
2301.1.2							X	X	X	X		X								
2301.1.3							X	X	X	X		X								
2301.1.3.1							X		X	X		X								
2301.1.3.2								X												
2301.2, Item 4, Exception							X	X	X	X		X								
2303.1.3.1							X	X	X	X		X								
> 2303.2 – 2303.2.9		X																		
2303.4.1.4.1, Exception 3							X	X	X	X		X								
2303.4.3.1							X	X	X	X		X								
2304.3.1.1			X	X																
2304.3.4							X	X	X	X		X								
2304.4.1							X	X												
2304.4.4.1									X	X		X								
2304.5							X	X												
2304.6.1, Exception							X		X			X								
2304.9.1.1							X		X	X		X								
2304.11.2.1.1																		X		
2304.11.2.2, Exception							X	X	X	X		X								
2304.11.2.4.1							X		X	X		X								
2304.11.2.8																		X		
> 2305.1.2							X	X	X	X		X								
2305.2, Exception							X		X	X		X								
2305.3, Exception							X	X	X	X		X								
2306.2, Exception							X	X	X	X		X								
> 2306.3, Exception							X	X	X	X		X								
2308.1																				
2308.2, Item 8							X	X		X										





## CHAPTER 23

# WOOD

### SECTION 2301 GENERAL

**2301.1 Scope.** The provisions of this chapter shall govern the materials, design, construction and quality of wood members and their fasteners.

**[HCD 1]** For limited-density owner-built rural dwellings, owner-produced or used materials and appliances may be utilized unless found not to be of sufficient strength or durability to perform the intended function; owner-produced or used lumber, or shakes and shingles may be utilized unless found to contain dry rot, excessive splitting or other defects obviously rendering the material unfit in strength or durability for the intended purpose.

**2301.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD 1, 2, & 4]** The scope of application of Chapter 23 is as follows:

1. Applications listed in Sections 1.9.2.1 and 1.9.2.2, regulated by the Division of the State Architect-Structural Safety (DSA-SS, and DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.
2. Applications listed in Section 1.10, regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.

**Exception:** For applications listed in Section 1.10.3 (Licensed Clinics), the provisions of this chapter without OSHPD amendments identified in accordance with Section 2301.1.2 shall apply.

**2301.1.2 Identification of amendments. [DSA-SS, DSA-SS/CC & OSHPD 1, 2 & 4]** Amendments appear in this chapter preceded with the appropriate acronym, as follows:

1. Division of the State Architect - Structural Safety:  
**[DSA-SS]** - For applications listed in Section 1.9.2.1.  
**[DSA-SS/CC]** - For applications listed in Section 1.9.2.2
2. Office of Statewide Health Planning and Development:  
**[OSHPD 1]** - For applications listed in Section 1.10.1.  
**[OSHPD 2]** - For applications listed in Section 1.10.2.  
**[OSHPD 4]** - For applications listed in Section 1.10.4.

**2301.1.3 Reference to other chapters.**

**2301.1.3.1 [DSA-SS and OSHPD 1 & 4]** Where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21, 22, and 34, the provisions in Chapters 16A, 17A, 18A, 19A, 21A, 22A, and 34A respectively shall apply instead.

**Exception:** For DSA-SS, the requirements of Chapter 34 shall apply instead of Chapter 34A

**2301.1.3.2 [DSA-SS/CC]** Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

**2301.2 General design requirements.** The design of structural elements or systems, constructed partially or wholly of wood or wood-based products, shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305 and 2306.
2. Load and resistance factor design in accordance with Sections 2304, 2305 and 2307.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.

**Exception:** Buildings designed in accordance with the provisions of the AF&PA WFCM shall be deemed to meet the requirements of the provisions of Section 2308.

4. The design and construction of log structures shall be in accordance with the provisions of ICC 400.

**Exception: [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4]** Log structures are not permitted by DSA and OSHPD.

**2301.3 Nominal sizes.** For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions (see Section 2304.2).

### SECTION 2302 DEFINITIONS

**2302.1 Definitions.** The following terms are defined in Chapter 2:

**ACCREDITATION BODY.**

**BRACED WALL LINE.**

**BRACED WALL PANEL.**

**COLLECTOR.**

**CONVENTIONAL LIGHT-FRAME CONSTRUCTION.**

**CRIPPLE WALL.**

**DIAPHRAGM, UNBLOCKED.**

**DRAW STRUT.**

**FIBERBOARD.**

**GLUED BUILT-UP MEMBER.****GRADE (LUMBER).****HARDBOARD.****NAILING, BOUNDARY.****NAILING, EDGE.****NAILING, FIELD.****NATURALLY DURABLE WOOD.***Decay resistant.**Termite resistant.***NOMINAL SIZE (LUMBER).****PARTICLEBOARD.****PERFORMANCE CATEGORY.****PREFABRICATED WOOD I-JOIST.****SHEAR WALL.***Shear wall, perforated.**Shear wall segment, perforated.***STRUCTURAL COMPOSITE LUMBER.***Laminated strand lumber (LSL).**Laminated veneer lumber (LVL).**Oriented strand lumber (OSL).**Parallel strand lumber (PSL).***STRUCTURAL GLUED-LAMINATED TIMBER.****SUBDIAPHRAGM.****TIE-DOWN (HOLD-DOWN).****TREATED WOOD.***Fire-retardant-treated wood.**Preservative-treated wood.***WOOD SHEAR PANEL.****WOOD STRUCTURAL PANEL.***Composite panels.**Oriented strand board (OSB).**Plywood.***SECTION 2303  
MINIMUM STANDARDS AND QUALITY**

**2303.1 General.** Structural sawn lumber; end-jointed lumber; prefabricated wood I-joists; structural glued-laminated timber; wood structural panels, fiberboard sheathing (when used structurally); hardboard siding (when used structurally); particleboard; preservative-treated wood; structural log members; structural composite lumber; round timber poles and piles; fire-retardant-treated wood; hardwood plywood; wood trusses; joist hangers; nails; and staples shall conform to the applicable provisions of this section.

**2303.1.1 Sawn lumber.** Sawn lumber used for load-supporting purposes, including end-jointed or edge-glued lumber, machine stress-rated or machine-evaluated lum-

ber, shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20 or equivalent. Grading practices and identification shall comply with rules published by an agency approved in accordance with the procedures of DOC PS 20 or equivalent procedures.

**2303.1.1.1 Certificate of inspection.** In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section is permitted to be accepted for precut, remanufactured or rough-sawn lumber and for sizes larger than 3 inches (76 mm) nominal thickness.

**2303.1.1.2 End-jointed lumber.** Approved end-jointed lumber is permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required to have a fire-resistance rating shall have the designation "Heat Resistant Adhesive" or "HRA" included in its grade mark.

**2303.1.2 Prefabricated wood I-joists.** Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D 5055.

**2303.1.3 Structural glued-laminated timber.** Glued-laminated timbers shall be manufactured and identified as required in ANSI/AITC A 190.1 and ASTM D 3737.

**2303.1.3.1 Additional requirements.** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] The construction documents shall indicate the following:

1. Dry or wet service conditions.
2. Laminating combinations and stress requirements.
3. Species group.
4. Preservative material and retention, when preservative treatment is required.
5. Provisions for protection during shipping and field handling, such as sealing and wrapping in accordance with AITC 111.

When mechanical reinforcement such as radial tension reinforcement is required, such reinforcement shall comply with AITC 404 and shall be detailed accordingly in the construction documents. Construction documents shall specify that the moisture content of laminations at the time of manufacture shall not exceed 12 percent for dry conditions of use.

The design of fasteners and connections shall comply with AITC 117, Section I, Item 6 (Connection Design), and NDS Appendix E.

Refer to Section 1705A.5.4 for special inspection requirements during fabrication of structural glued laminated timbers.

**Exception:** [OSHPD 2] Special inspection shall be per Chapter 17 instead of 17A.

**2303.1.4 Wood structural panels.** Wood structural panels, when used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for their type in DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Each panel or member shall be identified for grade, bond classification, and Performance Category by the trademarks of an approved testing and grading agency. The Performance Category value shall be used as the “nominal panel thickness” or “panel thickness” whenever referenced in this code. Wood structural panel components shall be designed and fabricated in accordance with the applicable standards listed in Section 2306.1 and identified by the trademarks of an approved testing and inspection agency indicating conformance to the applicable standard. In addition, wood structural panels when permanently exposed in outdoor applications shall be of Exterior type, except that wood structural panel roof sheathing exposed to the outdoors on the underside is permitted to be Exposure 1 type.

**2303.1.5 Fiberboard.** Fiberboard for its various uses shall conform to ASTM C 208. Fiberboard sheathing, when used structurally, shall be identified by an approved agency as conforming to ASTM C 208.

**2303.1.5.1 Jointing.** To ensure tight-fitting assemblies, edges shall be manufactured with square, shiplapped, beveled, tongue-and-groove or U-shaped joints.

**2303.1.5.2 Roof insulation.** Where used as roof insulation in all types of construction, fiberboard shall be protected with an approved roof covering.

**2303.1.5.3 Wall insulation.** Where installed and fire-blocked to comply with Chapter 7, fiberboards are permitted as wall insulation in all types of construction. In fire walls and fire barriers, unless treated to comply with Section 803.1 for Class A materials, the boards shall be cemented directly to the concrete, masonry or other noncombustible base and shall be protected with an approved noncombustible veneer anchored to the base without intervening airspaces.

**2303.1.5.3.1 Protection.** Fiberboard wall insulation applied on the exterior of foundation walls shall be protected below ground level with a bituminous coating.

**2303.1.6 Hardboard.** Hardboard siding used structurally shall be identified by an approved agency conforming to CPA/ANSI A135.6. Hardboard underlayment shall meet the strength requirements of  $\frac{7}{32}$ -inch (5.6 mm) or  $\frac{1}{4}$ -inch (6.4 mm) service class hardboard planed or sanded on one side to a uniform thickness of not less than 0.200 inch (5.1 mm). Prefinished hardboard paneling shall meet the requirements of CPA/ANSI A135.5. Other basic hardboard products shall meet the requirements of CPA/ANSI A135.4. Hardboard products shall be installed in accordance with manufacturer's recommendations.

**2303.1.7 Particleboard.** Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency. Particleboard shall not be utilized for

applications other than indicated in this section unless the particleboard complies with the provisions of Section 2306.3.

**2303.1.7.1 Floor underlayment.** Particleboard floor underlayment shall conform to Type PBU of ANSI A208.1. Type PBU underlayment shall not be less than  $\frac{1}{4}$ -inch (6.4 mm) thick and shall be installed in accordance with the instructions of the Composite Panel Association.

**2303.1.8 Preservative-treated wood.** Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.11 to be preservative treated shall conform to the requirements of the applicable AWWA Standard U1 and M4 for the species, product, preservative and end use. Preservatives shall be listed in Section 4 of AWWA U1. Lumber and plywood used in wood foundation systems shall conform to Chapter 18.

**2303.1.8.1 Identification.** Wood required by Section 2304.11 to be preservative treated shall bear the quality mark of an inspection agency that maintains continuing supervision, testing and inspection over the quality of the preservative-treated wood. Inspection agencies for preservative-treated wood shall be listed by an accreditation body that complies with the requirements of the American Lumber Standards Treated Wood Program, or equivalent. The quality mark shall be on a stamp or label affixed to the preservative-treated wood, and shall include the following information:

1. Identification of treating manufacturer.
2. Type of preservative used.
3. Minimum preservative retention (pcf).
4. End use for which the product is treated.
5. AWWA standard to which the product was treated.
6. Identity of the accredited inspection agency.

**2303.1.8.2 Moisture content.** Where preservative-treated wood is used in enclosed locations where drying in service cannot readily occur, such wood shall be at a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering or other materials.

**2303.1.9 Structural composite lumber.** Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D 5456.

**2303.1.10 Structural log members.** Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted.

**2303.1.11 Round timber poles and piles.** Round timber poles and piles shall comply with ASTM D 3200 and ASTM D 25, respectively.

**2303.2 Fire-retardant-treated wood.** Fire-retardant-treated wood is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84 or UL 723, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10½ feet (3200 mm) beyond the centerline of the burners at any time during the test.

**2303.2.1 Pressure process.** For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (345 kPa).

**2303.2.2 Other means during manufacture.** For wood products produced by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product.

**2303.2.3 Testing.** For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section 2303.2. Wood structural panels shall be permitted to test only the front and back faces.

**2303.2.4 Labeling.** Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain the following items:

1. The identification mark of an approved agency in accordance with Section 1703.5.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke-developed index.
6. Method of drying after treatment.
7. Conformance with appropriate standards in accordance with Sections 2303.2.2 through 2303.2.5.
8. For fire-retardant-treated wood exposed to weather, damp or wet locations, include the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D 2898).

**2303.2.5 Strength adjustments.** Design values for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for fire-retardant-treated wood. Adjustments to design values shall be based on an approved method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

**2303.2.5.1 Wood structural panels.** The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated soft-

wood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.

**2303.2.5.2 Lumber.** For each species of wood that is treated, the effects of the treatment, the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D 6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

**2303.2.6 Exposure to weather, damp or wet locations.** Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as "Exterior" to indicate there is no increase in the listed flame spread index as defined in Section 2303.2 when subjected to ASTM D 2898.

**2303.2.7 Interior applications.** Interior fire-retardant-treated wood shall have moisture content of not over 28 percent when tested in accordance with ASTM D 3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section 2303.2.5.1 or 2303.2.5.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

**2303.2.8 Moisture content.** Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT), the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section 2303.2.5.1 for plywood and 2303.2.5.2 for lumber.

**2303.2.9 Type I and II construction applications.** See Section 603.1 for limitations on the use of fire-retardant-treated wood in buildings of Type I or II construction.

**2303.3 Hardwood and plywood.** Hardwood and decorative plywood shall be manufactured and identified as required in HPVA HP-1.

**2303.4 Trusses.** Wood trusses shall comply with Sections 2303.4.1 through 2303.4.7.

**2303.4.1 Design.** Wood trusses shall be designed in accordance with the provisions of this code and accepted engineering practice. Members are permitted to be joined by nails, glue, bolts, timber connectors, metal connector plates or other approved framing devices.

**2303.4.1.1 Truss design drawings.** The written, graphic and pictorial depiction of each individual truss shall be provided to the building official for approval prior to installation. Truss design drawings shall also be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the information specified below:

1. Slope or depth, span and spacing;
2. Location of all joints and support locations;
3. Number of plies if greater than one;
4. Required bearing widths;
5. Design loads as applicable, including;
  - 5.1. Top chord live load;
  - 5.2. Top chord dead load;
  - 5.3. Bottom chord live load;
  - 5.4. Bottom chord dead load;
  - 5.5. Additional loads and locations; and
  - 5.6. Environmental design criteria and loads (wind, rain, snow, seismic, etc.).
6. Other lateral loads, including drag strut loads;
7. Adjustments to wood member and metal connector plate design value for conditions of use;
8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable;
9. Metal-connector-plate type, size and thickness or gage, and the dimensioned location of each metal connector plate except where symmetrically located relative to the joint interface;
10. Size, species and grade for each wood member;
11. Truss-to-truss connections and truss field assembly requirements;
12. Calculated span-to-deflection ratio and maximum vertical and horizontal deflection for live and total load as applicable;
13. Maximum axial tension and compression forces in the truss members; and
14. Required permanent individual truss member restraint location and the method and details of restraint/bracing to be used in accordance with Section 2303.4.1.2.

**2303.4.1.2 Permanent individual truss member restraint.** Where permanent restraint of truss members is required on the truss design drawings, it shall be accomplished by one of the following methods:

1. Permanent individual truss member restraint/bracing shall be installed using standard industry lateral restraint/bracing details in accordance with generally accepted engineering practice. Locations for lateral restraint shall be identified on the truss design drawing.

2. The trusses shall be designed so that the buckling of any individual truss member is resisted internally by the individual truss through suitable means (i.e., buckling reinforcement by T-reinforcement or L-reinforcement, proprietary reinforcement, etc.). The buckling reinforcement of individual members of the trusses shall be installed as shown on the truss design drawing or on supplemental truss member buckling reinforcement details provided by the truss designer.
3. A project-specific permanent individual truss member restraint/bracing design shall be permitted to be specified by any registered design professional.

**2303.4.1.3 Trusses spanning 60 feet or greater.** The owner shall contract with any qualified registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for all trusses with clear spans 60 feet (18 288 mm) or greater.

**2303.4.1.4 Truss designer.** The individual or organization responsible for the design of trusses.

**2303.4.1.4.1 Truss design drawings.** Where required by the registered design professional, the building official or the statutes of the jurisdiction in which the project is to be constructed, each individual truss design drawing shall bear the seal and signature of the truss designer.

#### Exceptions:

1. Where a cover sheet and truss index sheet are combined into a single sheet and attached to the set of truss design drawings, the single cover/truss index sheet is the only document required to be signed and sealed by the truss designer.
2. When a cover sheet and a truss index sheet are separately provided and attached to the set of truss design drawings, the cover sheet and the truss index sheet are the only documents required to be signed and sealed by the truss designer.
3. *[DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] Exceptions 1 and 2 are not permitted by DSA and OSHPD.*

**2303.4.2 Truss placement diagram.** The truss manufacturer shall provide a truss placement diagram that identifies the proposed location for each individually designated truss and references the corresponding truss design drawing. The truss placement diagram shall be provided as part of the truss submittal package, and with the shipment of trusses delivered to the job site. Truss placement diagrams that serve only as a guide for installation and do not deviate from the permit submittal drawings shall not be required to bear the seal or signature of the truss designer.

**2303.4.3 Truss submittal package.** The truss submittal package provided by the truss manufacturer shall consist of each individual truss design drawing, the truss place-

ment diagram, the permanent individual truss member restraint/bracing method and details and any other structural details germane to the trusses; and, as applicable, the cover/truss index sheet.

**2303.4.3.1 Additional requirements.** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] In addition to Sections 2303.4.1 and 2303.4.2, the following requirements apply:

1. **Construction documents.** The construction documents prepared by the registered engineer or licensed architect for the project shall indicate all requirements for the truss design, including:
  - 1.1 Deflection criteria.
  - 1.2 Connection details to structural and non-structural elements (e.g. non-bearing partitions).
2. **Requirements for approval.** The truss design drawings and engineering analysis shall be provided to the enforcement agency and approved prior to truss fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Alterations to the approved truss design drawings or manufactured trusses are subject to the approval of the enforcement agency.-
3. **Special inspection during truss manufacture.** Refer to Section 1705A.5.5 for special inspection requirements during the manufacture of open-web trusses.

**2303.4.4 Anchorage.** The design for the transfer of loads and anchorage of each truss to the supporting structure is the responsibility of the registered design professional.

**2303.4.5 Alterations to trusses.** Truss members and components shall not be cut, notched, drilled, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (e.g., HVAC equipment, piping, additional roofing or insulation, etc.) shall not be permitted without verification that the truss is capable of supporting such additional loading.

**2303.4.6 TPI 1 specifications.** In addition to Sections 2303.4.1 through 2303.4.5, the design, manufacture and quality assurance of metal-plate-connected wood trusses shall be in accordance with TPI 1. Job-site inspections shall be in compliance with Section 110.4, as applicable.

**2303.4.7 Truss quality assurance.** Trusses not part of a manufacturing process in accordance with either Section 2303.4.6 or a referenced standard, which provides requirements for quality control done under the supervision of a third-party quality control agency, shall be manufactured in compliance with Sections 1704.2.5 and 1705.5, as applicable.

**2303.5 Test standard for joist hangers.** For the required test standards for joist hangers see Section 1711.1.

**2303.6 Nails and staples.** Nails and staples shall conform to requirements of ASTM F 1667. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows: 80 kips per square inch (ksi) (551

MPa) for shank diameters larger than 0.177 inch (4.50 mm) but not larger than 0.254 inch (6.45 mm), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch (3.61 mm) but not larger than 0.177 inch (4.50 mm) and 100 ksi (689 MPa) for shank diameters of at least 0.099 inch (2.51 mm) but not larger than 0.142 inch (3.61 mm).

**2303.7 Shrinkage.** Consideration shall be given in design to the possible effect of cross-grain dimensional changes considered vertically which may occur in lumber fabricated in a green condition.

## SECTION 2304 GENERAL CONSTRUCTION REQUIREMENTS

**2304.1 General.** The provisions of this section apply to design methods specified in Section 2301.2.

**2304.2 Size of structural members.** Computations to determine the required sizes of members shall be based on the net dimensions (actual sizes) and not nominal sizes.

**2304.3 Wall framing.** The framing of exterior and interior walls shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

**2304.3.1 Bottom plates.** Studs shall have full bearing on a 2-inch-thick (actual 1½-inch, 38 mm) or larger plate or sill having a width at least equal to the width of the studs.

**2304.3.1.1 [HCD 1] Rodent proofing.** Annular spaces around pipes, electric cables, conduits or other openings in bottom/sole plates at exterior walls shall be protected against the passage of rodents by closing such openings in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.4.

**2304.3.2 Framing over openings.** Headers, double joists, trusses or other approved assemblies that are of adequate size to transfer loads to the vertical members shall be provided over window and door openings in load-bearing walls and partitions.

**2304.3.3 Shrinkage.** Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the building official shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems, or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall also show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

**2304.3.4 Additional requirements.** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] The following additional requirements apply:

1. Engineering analysis shall be furnished that demonstrates compliance of wall framing elements and connections with Section 2301.2, Item 1 or 2.
2. Construction documents shall include detailing of sill plate anchorage to supporting masonry or con-

crete for all exterior and interior bearing, nonbearing and shear walls. Unless specifically designed in accordance with Item 1 above, sills under exterior walls, bearing walls and shear walls shall be bolted to masonry or concrete with  $\frac{5}{8}$  inch diameter by 12-inch (16 mm by 305 mm) bolts spaced not more than four (4) feet (1219 mm) on center, with a minimum of two (2) bolts for each piece of sill plate. Anchor bolts shall have a 4 inch minimum and a 12-inch maximum clearance to the end of the sill plate, and 7-inch minimum embedment into concrete or masonry.

Unless specifically designed in accordance with Item 1 above, sill plates under nonbearing interior partitions on concrete floor slabs shall be anchored at not more than four (4) feet (1219 mm) on center to resist a minimum allowable stress shear of 100 pounds per linear foot (1.4 kN/m) acting either parallel or perpendicular to the wall.

3. Construction documents shall include detailing and limitations for notches and bored holes in wall studs, plates and sills.

**2304.4 Floor and roof framing.** The framing of wood-joisted floors and wood framed roofs shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

**2304.4.1 Additional requirements.** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] The following additional requirements apply:

1. Engineering analysis shall be furnished that demonstrates compliance of floor, roof and ceiling framing elements and connections with Section 2301.2, Items 1 or 2.
2. Construction documents shall include detailing and limitations for notches and bored holes in floor and roof framing members.

**2304.5 Framing around flues and chimneys.** Combustible framing shall be a minimum of 2 inches (51 mm), but shall not be less than the distance specified in Sections 2111 and 2113 and the *California Mechanical Code*, from flues, chim-

neys and fireplaces, and 6 inches (152 mm) away from flue openings.

**2304.6 Wall sheathing.** Except as provided for in Section 1405 for weatherboarding or where stucco construction that complies with Section 2510 is installed, enclosed buildings shall be sheathed with one of the materials of the nominal thickness specified in Table 2304.6 or any other approved material of equivalent strength or durability.

**2304.6.1 Wood structural panel sheathing.** Where wood structural panel sheathing is used as the exposed finish on the outside of exterior walls, it shall have an exterior exposure durability classification. Where wood structural panel sheathing is used elsewhere, but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior). Wood structural panel wall sheathing or siding used as structural sheathing shall be capable of resisting wind pressures in accordance with Section 1609. Maximum wind speeds for wood structural panel sheathing used to resist wind pressures shall be in accordance with Table 2304.6.1 for enclosed buildings with a mean roof height not greater than 30 feet (9144 mm) and a topographic factor ( $K_{zt}$ ) of 1.0.

**Exception:** [DSA-SS and OSHPD 1 & 4] Wind pressure shall be calculated in accordance with Section 1609A.

**2304.6.2 Interior paneling.** Softwood wood structural panels used for interior paneling shall conform to the provisions of Chapter 8 and shall be installed in accordance with Table 2304.9.1. Panels shall comply with DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Prefinished hardboard paneling shall meet the requirements of CPA/ANSI A135.5. Hardwood plywood shall conform to HPVA HP-1.

**2304.7 Floor and roof sheathing.** Structural floor sheathing and structural roof sheathing shall comply with Sections 2304.7.1 and 2304.7.2, respectively.

**2304.7.1 Structural floor sheathing.** Structural floor sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Floor sheathing conforming to the provisions of Table 2304.7(1), 2304.7(2), 2304.7(3) or 2304.7(4) shall be deemed to meet the requirements of this section.

**TABLE 2304.6**  
**MINIMUM THICKNESS OF WALL SHEATHING**

SHEATHING TYPE	MINIMUM THICKNESS	MAXIMUM WALL STUD SPACING
Wood boards	$\frac{5}{8}$ inch	24 inches on center
Fiberboard	$\frac{1}{2}$ inch	16 inches on center
Wood structural panel	In accordance with Tables 2308.9.3(2) and 2308.9.3(3)	—
M-S "Exterior Glue" and M-2 "Exterior Glue" Particleboard	In accordance with Section 2306.3 and Table 2308.9.3(4)	—
Gypsum sheathing	$\frac{1}{2}$ inch	16 inches on center
Gypsum wallboard	$\frac{1}{2}$ inch	24 inches on center
Reinforced cement mortar	1 inch	24 inches on center

For SI: 1 inch = 25.4 mm.



**TABLE 2304.6.1**  
**MAXIMUM NOMINAL DESIGN WIND SPEED,  $V_{asd}$ , PERMITTED FOR**  
**WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES<sup>a, b, c</sup>**

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		MAXIMUM NOMINAL DESIGN WIND SPEED, $V_{asd}^d$ (MPH)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d common (2.0" × 0.113")	1.5	24/0	$\frac{3}{8}$	16	6	12	110	90	85
		24/16	$\frac{7}{16}$	16	6	12	110	100	90
						6	150	125	110
8d common (2.5" × 0.131")	1.75	24/16	$\frac{7}{16}$	16	6	12	130	110	105
				24	6	6	150	125	110
						12	110	90	85
						6	110	90	85

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- Panel strength axis shall be parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.
- The table is based on wind pressures acting toward and away from building surfaces in accordance with Section 30.7 of ASCE 7. Lateral requirements shall be in accordance with Section 2305 or 2308.
- Wood structural panels with span ratings of wall-16 or wall-24 shall be permitted as an alternative to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternative to panels with a 24/16 span rating. Wall-16 and plywood siding 16 o.c. shall be used with studs spaced a maximum of 16 inches o.c.
- $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

**TABLE 2304.7(1)**  
**ALLOWABLE SPANS FOR LUMBER FLOOR AND ROOF SHEATHING<sup>a, b</sup>**

SPAN (inches)	MINIMUM NET THICKNESS (inches) OF LUMBER PLACED			
	Perpendicular to supports		Diagonally to supports	
	Surfaced dry <sup>c</sup>	Surfaced unseasoned	Surfaced dry <sup>c</sup>	Surfaced unseasoned
<b>Floors</b>				
24	$\frac{3}{4}$	$\frac{25}{32}$	$\frac{3}{4}$	$\frac{25}{32}$
16	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{5}{8}$	$\frac{11}{16}$
<b>Roofs</b>				
24	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{25}{32}$

For SI: 1 inch = 25.4 mm.

- Installation details shall conform to Sections 2304.7.1 and 2304.7.2 for floor and roof sheathing, respectively.
- Floor or roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 2304.7.
- Maximum 19-percent moisture content.

**TABLE 2304.7(2)**  
**SHEATHING LUMBER, MINIMUM GRADE REQUIREMENTS: BOARD GRADE**

SOLID FLOOR OR ROOF SHEATHING	SPACED ROOF SHEATHING	GRADING RULES
Utility	Standard	NLGA, WCLIB, WWPA
4 common or utility	3 common or standard	NLGA, WCLIB, WWPA, NSLB or NELMA
No. 3	No. 2	SPIB
Merchantable	Construction common	RIS

**TABLE 2304.7(3)**  
**ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANEL SHEATHING AND**  
**SINGLE-FLOOR GRADES CONTINUOUS OVER TWO OR MORE SPANS WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS<sup>a, b</sup>**

SHEATHING GRADES		ROOF <sup>c</sup>				FLOOR <sup>d</sup>
Panel span rating roof/ floor span	Panel thickness (inches)	Maximum span (inches)		Load <sup>e</sup> (psf)		Maximum span (inches)
		With edge support <sup>f</sup>	Without edge support	Total load	Live load	
16/0	$\frac{3}{8}$	16	16	40	30	0
20/0	$\frac{3}{8}$	20	20	40	30	0
24/0	$\frac{3}{8}, \frac{7}{16}, \frac{1}{2}$	24	20 <sup>g</sup>	40	30	0
24/16	$\frac{7}{16}, \frac{1}{2}$	24	24	50	40	16
32/16	$\frac{15}{32}, \frac{1}{2}, \frac{5}{8}$	32	28	40	30	16 <sup>h</sup>
40/20	$\frac{19}{32}, \frac{5}{8}, \frac{3}{4}, \frac{7}{8}$	40	32	40	30	20 <sup>h,i</sup>
48/24	$\frac{23}{32}, \frac{3}{4}, \frac{7}{8}$	48	36	45	35	24
54/32	$\frac{7}{8}, 1$	54	40	45	35	32
60/32	$\frac{7}{8}, 1\frac{1}{8}$	60	48	45	35	32
SINGLE FLOOR GRADES		ROOF <sup>c</sup>				FLOOR <sup>d</sup>
Panel span rating	Panel thickness (inches)	Maximum span (inches)		Load <sup>e</sup> (psf)		Maximum span (inches)
		With edge support <sup>f</sup>	Without edge support	Total load	Live load	
16 o.c.	$\frac{1}{2}, \frac{19}{32}, \frac{5}{8}$	24	24	50	40	16 <sup>h</sup>
20 o.c.	$\frac{19}{32}, \frac{5}{8}, \frac{3}{4}$	32	32	40	30	20 <sup>h,i</sup>
24 o.c.	$\frac{23}{32}, \frac{3}{4}$	48	36	35	25	24
32 o.c.	$\frac{7}{8}, 1$	48	40	50	40	32
48 o.c.	$1\frac{3}{32}, 1\frac{1}{8}$	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

- Applies to panels 24 inches or wider.
- Floor and roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 2304.7.
- Uniform load deflection limitations  $\frac{1}{180}$  of span under live load plus dead load,  $\frac{1}{240}$  under live load only.
- Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking unless  $\frac{1}{4}$ -inch minimum thickness underlayment or  $1\frac{1}{2}$  inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is  $\frac{3}{4}$ -inch wood strip. Allowable uniform load based on deflection of  $\frac{1}{360}$  of span is 100 pounds per square foot except the span rating of 48 inches on center is based on a total load of 65 pounds per square foot.
- Allowable load at maximum span.
- Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking or other. Only lumber blocking shall satisfy blocked diaphragm requirements.
- For  $\frac{1}{2}$ -inch panel, maximum span shall be 24 inches.
- Span is permitted to be 24 inches on center where  $\frac{3}{4}$ -inch wood strip flooring is installed at right angles to joist.
- Span is permitted to be 24 inches on center for floors where  $1\frac{1}{2}$  inches of cellular or lightweight concrete is applied over the panels.

**TABLE 2304.7(4)**  
**ALLOWABLE SPAN FOR WOOD STRUCTURAL PANEL COMBINATION SUBFLOOR-UNDERLAYMENT (SINGLE FLOOR)<sup>a, b</sup>**  
**(Panels Continuous Over Two or More Spans and Strength Axis Perpendicular to Supports)**

IDENTIFICATION	MAXIMUM SPACING OF JOISTS (inches)				
	16	20	24	32	48
Species group <sup>c</sup>	Thickness (inches)				
1	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	—	—
2, 3	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	—	—
4	$\frac{3}{4}$	$\frac{7}{8}$	1	—	—
Single floor span rating <sup>d</sup>	16 o.c.	20 o.c.	24 o.c.	32 o.c.	48 o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

- Spans limited to value shown because of possible effects of concentrated loads. Allowable uniform loads based on deflection of  $\frac{1}{360}$  of span is 100 pounds per square foot except allowable total uniform load for  $1\frac{1}{8}$ -inch wood structural panels over joists spaced 48 inches on center is 65 pounds per square foot. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless  $\frac{1}{4}$ -inch minimum thickness underlayment or  $1\frac{1}{2}$  inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is  $\frac{3}{4}$ -inch wood strip.
- Floor panels conforming with this table shall be deemed to meet the design criteria of Section 2304.7.
- Applicable to all grades of sanded exterior-type plywood. See DOC PS 1 for plywood species groups.
- Applicable to Underlayment grade, C-C (Plugged) plywood, and Single Floor grade wood structural panels.

**TABLE 2304.7(5)**  
**ALLOWABLE LOAD (PSF) FOR WOOD STRUCTURAL PANEL ROOF SHEATHING CONTINUOUS**  
**OVER TWO OR MORE SPANS AND STRENGTH AXIS PARALLEL TO SUPPORTS**  
**(Plywood Structural Panels Are Five-Ply, Five-Layer Unless Otherwise Noted)<sup>a, b</sup>**

PANEL GRADE	THICKNESS (inch)	MAXIMUM SPAN (inches)	LOAD AT MAXIMUM SPAN (psf)	
			Live	Total
Structural I sheathing	$\frac{7}{16}$	24	20	30
	$\frac{15}{32}$	24	35 <sup>c</sup>	45 <sup>c</sup>
	$\frac{1}{2}$	24	40 <sup>c</sup>	50 <sup>c</sup>
	$\frac{19}{32}, \frac{5}{8}$	24	70	80
	$\frac{23}{32}, \frac{3}{4}$	24	90	100
Sheathing, other grades covered in DOC PS 1 or DOC PS 2	$\frac{7}{16}$	16	40	50
	$\frac{15}{32}$	24	20	25
	$\frac{1}{2}$	24	25	30
	$\frac{19}{32}$	24	40 <sup>c</sup>	50 <sup>c</sup>
	$\frac{5}{8}$	24	45 <sup>c</sup>	55 <sup>c</sup>
	$\frac{23}{32}, \frac{3}{4}$	24	60 <sup>c</sup>	65 <sup>c</sup>

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

a. Roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 2304.7.

b. Uniform load deflection limitations  $\frac{1}{180}$  of span under live load plus dead load,  $\frac{1}{240}$  under live load only. Edges shall be blocked with lumber or other approved type of edge supports.

c. For composite and four-ply plywood structural panel, load shall be reduced by 15 pounds per square foot.

**2304.7.2 Structural roof sheathing.** Structural roof sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Roof sheathing conforming to the provisions of Table 2304.7(1), 2304.7(2), 2304.7(3) or 2304.7(5) shall be deemed to meet the requirements of this section. Wood structural panel roof sheathing shall be bonded by exterior glue.

**2304.8 Lumber decking.** Lumber decking shall be designed and installed in accordance with the general provisions of this code and Sections 2304.8.1 through 2304.8.5.3.

**2304.8.1 General.** Each piece of lumber decking shall be square-end trimmed. When random lengths are furnished, each piece shall be square end trimmed across the face so that at least 90 percent of the pieces are within 0.5 degrees (0.00873 rad) of square. The ends of the pieces shall be permitted to be beveled up to 2 degrees (0.0349 rad) from the vertical with the exposed face of the piece slightly longer than the opposite face of the piece. Tongue-and-groove decking shall be installed with the tongues up on sloped or pitched roofs with pattern faces down.

**2304.8.2 Layup patterns.** Lumber decking is permitted to be laid up following one of five standard patterns as defined in Sections 2304.8.2.1 through 2304.8.2.5. Other patterns are permitted to be used provided they are substantiated through engineering analysis.

**2304.8.2.1 Simple span pattern.** All pieces shall be supported on their ends (i.e., by two supports).

**2304.8.2.2 Two-span continuous pattern.** All pieces shall be supported by three supports, and all end joints shall occur in line on alternating supports. Supporting members shall be designed to accommodate the load redistribution caused by this pattern.

**2304.8.2.3 Combination simple and two-span continuous pattern.** Courses in end spans shall be alternating simple-span pattern and two-span continuous pattern. End joints shall be staggered in adjacent courses and shall bear on supports.

**2304.8.2.4 Cantilevered pieces intermixed pattern.** The decking shall extend across a minimum of three spans. Pieces in each starter course and every third course shall be simple span pattern. Pieces in other courses shall be cantilevered over the supports with end joints at alternating quarter or third points of the spans. Each piece shall bear on at least one support.

**2304.8.2.5 Controlled random pattern.** The decking shall extend across a minimum of three spans. End joints of pieces within 6 inches (152 mm) of the end joints of the adjacent pieces in either direction shall be separated by at least two intervening courses. In the end bays, each piece shall bear on at least one support. Where an end joint occurs in an end bay, the next piece in the same course shall continue over the first inner support for at least 24 inches (610 mm). The details of the controlled random pattern shall be as specified for each decking material in Section 2304.8.3.3, 2304.8.4.3 or 2304.8.5.3.

Decking that cantilevers beyond a support for a horizontal distance greater than 18 inches (457 mm), 24 inches (610 mm) or 36 inches (914 mm) for 2-inch (51

mm), 3-inch (76 mm) and 4-inch (102 mm) nominal thickness decking, respectively, shall comply with the following:

1. The maximum cantilevered length shall be 30 percent of the length of the first adjacent interior span.
2. A structural fascia shall be fastened to each decking piece to maintain a continuous, straight line.
3. There shall be no end joints in the decking between the cantilevered end of the decking and the centerline of the first adjacent interior span.

**2304.8.3 Mechanically laminated decking.** Mechanically laminated decking shall comply with Sections 2304.8.3.1 through 2304.8.3.3.

**2304.8.3.1 General.** Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.

**2304.8.3.2 Nailing.** The length of nails connecting laminations shall not be less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center (o.c.) or less, side nails shall be installed not more than 30 inches (762 mm) o.c. alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) o.c., side nails shall be installed not more than 18 inches (457 mm) o.c. alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. Two side nails shall be installed at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) o.c. or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) o.c., alternate laminations shall be toenailed to every support.

**2304.8.3.3 Controlled random pattern.** There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on at least two supports with end joints in these two courses occurring on alternate supports. A maximum of seven intervening courses shall be permitted before this pattern is repeated.

**2304.8.4 Two-inch sawn tongue-and-groove decking.** Two-inch (51 mm) sawn tongue-and-groove decking shall comply with Sections 2304.8.4.1 through 2304.8.4.3.

**2304.8.4.1 General.** Two-inch (51 mm) decking shall have a maximum moisture content of 15 percent. Decking shall be machined with a single tongue-and-groove pattern. Each decking piece shall be nailed to each support.

**2304.8.4.2 Nailing.** Each piece of decking shall be toenailed at each support with one 16d common nail through the tongue and face-nailed with one 16d common nail.

**2304.8.4.3 Controlled random pattern.** There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on at least two supports with end joints in these two courses occurring on alternate supports. A maximum of seven intervening courses shall be permitted before this pattern is repeated.

**2304.8.5 Three- and four-inch sawn tongue-and-groove decking.** Three- and four-inch (76 mm and 102 mm) sawn tongue-and-groove decking shall comply with Sections 2304.8.5.1 through 2304.8.5.3.

**2304.8.5.1 General.** Three-inch (76 mm) and four-inch (102 mm) decking shall have a maximum moisture content of 19 percent. Decking shall be machined with a double tongue-and-groove pattern. Decking pieces shall be interconnected and nailed to the supports.

**2304.8.5.2 Nailing.** Each piece shall be toenailed at each support with one 40d common nail and face-nailed with one 60d common nail. Courses shall be spiked to each other with 8-inch (203 mm) spikes at maximum intervals of 30 inches (762 mm) through pre-drilled edge holes penetrating to a depth of approximately 4 inches (102 mm). One spike shall be installed at a distance not exceeding 10 inches (254 mm) from the end of each piece.

**2304.8.5.3 Controlled random pattern.** There shall be a minimum distance of 48 inches (1219 mm) between end joints in adjacent courses. Pieces not bearing on a support are permitted to be located in interior bays provided the adjacent pieces in the same course continue over the support for at least 24 inches (610 mm). This condition shall not occur more than once in every six courses in each interior bay.

**2304.9 Connectors and fasteners.** Connectors and fasteners shall comply with the applicable provisions of Sections 2304.9.1 through 2304.9.7.

**2304.9.1 Fastener requirements.** Connections for wood members shall be designed in accordance with the appropriate methodology in Section 2301.2. The number and size of fasteners connecting wood members shall not be less than that set forth in Table 2304.9.1.

**2304.9.1.1 Additional requirements.** [DSA-SS and OSHPD 1, 2 & 4] Fasteners used for the attachment of exterior wall coverings shall be of hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A 153. The coating weights for mechanically deposited zinc coated fasteners shall be in accordance with ASTM B 695, Class 55 minimum.

**TABLE 2304.9.1  
FASTENING SCHEDULE**

CONNECTION	FASTENING <sup>a, m</sup>	LOCATION
1. Joist to sill or girder	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	toenail
2. Bridging to joist	2 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 2 - 3" $\times$ 0.131" nails 2 - 3" 14 gage staples	toenail each end
3. 1" $\times$ 6" subfloor or less to each joist	2 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131")	face nail
4. Wider than 1" $\times$ 6" subfloor to each joist	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131")	face nail
5. 2" subfloor to joist or girder	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	blind and face nail
6. Sole plate to joist or blocking	16d ( $3\frac{1}{2}$ " $\times$ 0.135") at 16" o.c. 3" $\times$ 0.131" nails at 8" o.c. 3" 14 gage staples at 12" o.c.	typical face nail
Sole plate to joist or blocking at braced wall panel	3 - 16d ( $3\frac{1}{2}$ " $\times$ 0.135") at 16" o.c. 4 - 3" $\times$ 0.131" nails at 16" o.c. 4 - 3" 14 gage staples at 16" o.c.	braced wall panels
7. Top plate to stud	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	end nail
8. Stud to sole plate	4 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 4 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	toenail
	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	end nail
9. Double studs	16d ( $3\frac{1}{2}$ " $\times$ 0.135") at 24" o.c. 3" $\times$ 0.131" nail at 8" o.c. 3" 14 gage staple at 8" o.c.	face nail
10. Double top plates	16d ( $3\frac{1}{2}$ " $\times$ 0.135") at 16" o.c. 3" $\times$ 0.131" nail at 12" o.c. 3" 14 gage staple at 12" o.c.	typical face nail
Double top plates	8 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 12 - 3" $\times$ 0.131" nails 12 - 3" 14 gage staples	lap splice
11. Blocking between joists or rafters to top plate	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	toenail
12. Rim joist to top plate	8d ( $2\frac{1}{2}$ " $\times$ 0.131") at 6" o.c. 3" $\times$ 0.131" nail at 6" o.c. 3" 14 gage staple at 6" o.c.	toenail
13. Top plates, laps and intersections	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	face nail
14. Continuous header, two pieces	16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	16" o.c. along edge
15. Ceiling joists to plate	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 5 - 3" $\times$ 0.131" nails 5 - 3" 14 gage staples	toenail
16. Continuous header to stud	4 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131")	toenail

(continued)

**TABLE 2304.9.1—continued  
FASTENING SCHEDULE**

CONNECTION	FASTENING <sup>a, m</sup>	LOCATION
17. Ceiling joists, laps over partitions (see Section 2308.10.4.1, Table 2308.10.4.1)	3 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") minimum, Table 2308.10.4.1 4 - 3" $\times$ 0.131" nails 4 - 3" 14 gage staples	face nail
18. Ceiling joists to parallel rafters (see Section 2308.10.4.1, Table 2308.10.4.1)	3 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") minimum, Table 2308.10.4.1 4 - 3" $\times$ 0.131" nails 4 - 3" 14 gage staples	face nail
19. Rafter to plate (see Section 2308.10.1, Table 2308.10.1)	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	toenail
20. 1" diagonal brace to each stud and plate	2 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131") 2 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	face nail
21. 1" $\times$ 8" sheathing to each bearing	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131")	face nail
22. Wider than 1" $\times$ 8" sheathing to each bearing	3 - 8d common ( $2\frac{1}{2}$ " $\times$ 0.131")	face nail
23. Built-up corner studs	16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3" $\times$ 0.131" nails 3" 14 gage staples	24" o.c. 16" o.c. 16" o.c.
24. Built-up girder and beams	20d common (4" $\times$ 0.192") 32" o.c. 3" $\times$ 0.131" nail at 24" o.c. 3" 14 gage staple at 24" o.c.	face nail at top and bottom staggered on opposite sides
	2 - 20d common (4" $\times$ 0.192") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	face nail at ends and at each splice
25. 2" planks	16d common ( $3\frac{1}{2}$ " $\times$ 0.162")	at each bearing
26. Collar tie to rafter	3 - 10d common (3" $\times$ 0.148") 4 - 3" $\times$ 0.131" nails 4 - 3" 14 gage staples	face nail
27. Jack rafter to hip	3 - 10d common (3" $\times$ 0.148") 4 - 3" $\times$ 0.131" nails 4 - 3" 14 gage staples	toenail
	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	face nail
28. Roof rafter to 2-by ridge beam	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	toenail
	2 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 3 - 3" $\times$ 0.131" nails 3 - 3" 14 gage staples	face nail
29. Joist to band joist	3 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 4 - 3" $\times$ 0.131" nails 4 - 3" 14 gage staples	face nail

(continued)

**TABLE 2304.9.1—continued  
FASTENING SCHEDULE**

CONNECTION	FASTENING <sup>a,m</sup>		LOCATION
30. Ledger strip	3 - 16d common ( $3\frac{1}{2}$ " $\times$ 0.162") 4 - 3" $\times$ 0.131" nails 4 - 3" 14 gage staples		face nail at each joist
31. Wood structural panels and particleboard <sup>b</sup> Subfloor, roof and wall sheathing (to framing)	$\frac{1}{2}$ " and less  $\frac{19}{32}$ " to $\frac{3}{4}$ "  $\frac{7}{8}$ " to 1" $1\frac{1}{8}$ " to $1\frac{1}{4}$ "  Single floor (combination subfloor-underlay- ment to framing) $\frac{3}{4}$ " and less $\frac{7}{8}$ " to 1" $1\frac{1}{8}$ " to $1\frac{1}{4}$ "	6d <sup>c,1</sup> $2\frac{3}{8}$ " $\times$ 0.113" nail <sup>n</sup> $1\frac{3}{4}$ " 16 gage <sup>o</sup> 8d <sup>d</sup> or 6d <sup>e</sup> $2\frac{3}{8}$ " $\times$ 0.113" nail <sup>p</sup> 2" 16 gage <sup>p</sup> 8d <sup>c</sup> 10d <sup>d</sup> or 8d <sup>e</sup>  6d <sup>e</sup> 8d <sup>e</sup> 10d <sup>d</sup> or 8d <sup>e</sup>	
32. Panel siding (to framing)	$\frac{1}{2}$ " or less $\frac{5}{8}$ "	6d <sup>f</sup> 8d <sup>f</sup>	
33. Fiberboard sheathing <sup>g</sup>	$\frac{1}{2}$ "  $\frac{25}{32}$ "	No. 11 gage roofing nail <sup>h</sup> 6d common nail ( $2$ " $\times$ 0.113") No. 16 gage staple <sup>i</sup> No. 11 gage roofing nail <sup>h</sup> 8d common nail ( $2\frac{1}{2}$ " $\times$ 0.131") No. 16 gage staple <sup>i</sup>	
34. Interior paneling	$\frac{1}{4}$ " $\frac{3}{8}$ "	4d <sup>j</sup> 6d <sup>k</sup>	

For SI: 1 inch = 25.4 mm.

- a. Common or box nails are permitted to be used except where otherwise stated.
- b. Nails spaced at 6 inches on center at edges, 12 inches at intermediate supports except 6 inches at supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
- c. Common or deformed shank (6d - 2"  $\times$  0.113"; 8d -  $2\frac{1}{2}$ "  $\times$  0.131"; 10d - 3"  $\times$  0.148").
- d. Common (6d - 2"  $\times$  0.113"; 8d -  $2\frac{1}{2}$ "  $\times$  0.131"; 10d - 3"  $\times$  0.148").
- e. Deformed shank (6d - 2"  $\times$  0.113"; 8d -  $2\frac{1}{2}$ "  $\times$  0.131"; 10d - 3"  $\times$  0.148").
- f. Corrosion-resistant siding (6d -  $1\frac{7}{8}$ "  $\times$  0.106"; 8d -  $2\frac{3}{8}$ "  $\times$  0.128") or casing (6d - 2"  $\times$  0.099"; 8d -  $2\frac{1}{2}$ "  $\times$  0.113") nail.
- g. Fasteners spaced 3 inches on center at exterior edges and 6 inches on center at intermediate supports, when used as structural sheathing. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications.
- h. Corrosion-resistant roofing nails with  $\frac{7}{16}$ -inch-diameter head and  $1\frac{1}{2}$ -inch length for  $\frac{1}{2}$ -inch sheathing and  $1\frac{3}{4}$ -inch length for  $\frac{25}{32}$ -inch sheathing.
- i. Corrosion-resistant staples with nominal  $\frac{7}{16}$ -inch crown or 1-inch crown and  $1\frac{1}{4}$ -inch length for  $\frac{1}{2}$ -inch sheathing and  $1\frac{1}{2}$ -inch length for  $\frac{25}{32}$ -inch sheathing. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- j. Casing ( $1\frac{1}{2}$ "  $\times$  0.080") or finish ( $1\frac{1}{2}$ "  $\times$  0.072") nails spaced 6 inches on panel edges, 12 inches at intermediate supports.
- k. Panel supports at 24 inches. Casing or finish nails spaced 6 inches on panel edges, 12 inches at intermediate supports.
- l. For roof sheathing applications, 8d nails ( $2\frac{1}{2}$ "  $\times$  0.113") are the minimum required for wood structural panels.
- m. Staples shall have a minimum crown width of  $\frac{7}{16}$  inch.
- n. For roof sheathing applications, fasteners spaced 4 inches on center at edges, 8 inches at intermediate supports.
- o. Fasteners spaced 4 inches on center at edges, 8 inches at intermediate supports for subfloor and wall sheathing and 3 inches on center at edges, 6 inches at intermediate supports for roof sheathing.
- p. Fasteners spaced 4 inches on center at edges, 8 inches at intermediate supports.

**2304.9.2 Sheathing fasteners.** Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

**2304.9.3 Joist hangers and framing anchors.** Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where approved. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with Section 1716.1.

**2304.9.4 Other fasteners.** Clips, staples, glues and other approved methods of fastening are permitted where approved.

**2304.9.5 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood.** Fasteners, including nuts and washers, and connectors in contact with preservative-treated and fire-retardant-treated wood shall be in accordance with Sections 2304.9.5.1 through 2304.9.5.4. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153.

**2304.9.5.1 Fasteners and connectors for preservative-treated wood.** Fasteners, including nuts and washers, in contact with preservative-treated wood shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum. Connectors that are used in exterior applications and in contact with preservative-treated wood shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, a minimum of ASTM A 653, type G185 zinc-coated galvanized steel, or equivalent, shall be used.

**Exception:** Plain carbon steel fasteners, including nuts and washers, in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

**2304.9.5.2 Fastenings for wood foundations.** Fastenings, including nuts and washers, for wood foundations shall be as required in AF&PA PWF.

**2304.9.5.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations.** Fasteners, including nuts and washers, for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.

**2304.9.5.4 Fasteners for fire-retardant-treated wood used in interior applications.** Fasteners, including nuts and washers, for fire-retardant-treated wood used

in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, Section 2304.9.5.3 shall apply.

**2304.9.6 Load path.** Where wall framing members are not continuous from foundation sill to roof, the members shall be secured to ensure a continuous load path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistant material not less than 0.040 inch (1.01 mm) nominal thickness.

**2304.9.7 Framing requirements.** Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive loads, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

**2304.10 Heavy timber construction.** Where a structure or portion thereof is required to be of Type IV construction by other provisions of this code, the building elements therein shall comply with the applicable provisions of Sections 2304.10.1 through 2304.10.5.

**2304.10.1 Columns.** Columns shall be continuous or superimposed throughout all stories by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with pintles and base plates, or by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other approved methods.

**2304.10.1.1 Column connections.** Girders and beams shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal loads across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof loads only.

**2304.10.2 Floor framing.** Approved wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, or they shall be supported by an approved metal hanger into which the ends of the beams shall be closely fitted.

**2304.10.3 Roof framing.** Every roof girder and at least every alternate roof beam shall be anchored to its supporting member; and every monitor and every sawtooth construction shall be anchored to the main roof construction. Such anchors shall consist of steel or iron bolts of sufficient strength to resist vertical uplift of the roof.

**2304.10.4 Floor decks.** Floor decks and covering shall not extend closer than  $\frac{1}{2}$  inch (12.7 mm) to walls. Such  $\frac{1}{2}$ -inch (12.7 mm) spaces shall be covered by a molding fastened to the wall either above or below the floor and arranged such that the molding will not obstruct the expansion or contraction movements of the floor. Corbeling of masonry walls under floors is permitted in place of such molding.



**2304.10.5 Roof decks.** Where supported by a wall, roof decks shall be anchored to walls to resist uplift forces determined in accordance with Chapter 16. Such anchors shall consist of steel or iron bolts of sufficient strength to resist vertical uplift of the roof.

**2304.11 Protection against decay and termites.** Wood shall be protected from decay and termites in accordance with the applicable provisions of Sections 2304.11.1 through 2304.11.9.

**2304.11.1 General.** Where required by this section, protection from decay and termites shall be provided by the use of naturally durable or preservative-treated wood.

**2304.11.2 Wood used above ground.** Wood used above ground in the locations specified in Sections 2304.11.2.1 through 2304.11.2.7, 2304.11.3 and 2304.11.5 shall be naturally durable wood or preservative-treated wood using water-borne preservatives, in accordance with AWPA U1 (Commodity Specifications A or F) for above-ground use.

**2304.11.2.1 Joists, girders and subfloor.** Where wood joists or the bottom of a wood structural floor without joists are closer than 18 inches (457 mm), or wood girders are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation, the floor construction (including posts, girders, joists and subfloor) shall be of naturally durable or preservative-treated wood.

**2304.11.2.1.1 [SPCB]** *There shall be a clearance of at least 18 inches (457 mm) between the underside of wood floor joists and the finished surface of the ground, and at least 12 inches (305 mm) between the underside of any other wood horizontal framing member and the finished surface of the ground. The ground underneath floor joists shall be leveled or smoothed off so as to maintain a reasonably even surface.*

**Exception:** *For purposes of structural pest control inspection, a minimum of 12 inches (305 mm) of clearance under-floor joists shall be considered adequate except that such clearance shall not be necessary where the subarea soil is of such a nature as to prevent excavation or where excavation would create a hazard from shifting soil or other causes.*

**2304.11.2.2 Wood supported by exterior foundation walls.** Wood framing members, including wood sheathing, that rest on exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or preservative-treated wood.

**Exception:** *[DSA-SS and OSHPD 1, 2 & 4] At exterior walls where the earth is paved with an asphalt or concrete slab at least 18 inches (457 mm) wide and draining away from the building, the bottom of sills are permitted to be 6 inches (152 mm) above the top of such slab. Other equivalent means of termite and decay protection may be accepted by the enforcement agency.*

**2304.11.2.3 Exterior walls below grade.** Wood framing members and furring strips attached directly to the interior of exterior masonry or concrete walls below grade shall be of naturally durable or preservative-treated wood.

**2304.11.2.4 Sleepers and sills.** Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or preservative-treated wood.

**2304.11.2.4.1 Additional requirements.** *[DSA-SS and OSHPD 1, 2 & 4] Stud walls or partitions at shower or toilet rooms with more than two fixtures, and stud walls adjacent to unroofed paved areas shall rest on a concrete curb extending at least 6 inches (152 mm) above finished floor or pavement level.*

**2304.11.2.5 Girder ends.** The ends of wood girders entering exterior masonry or concrete walls shall be provided with a 1/2-inch (12.7 mm) air space on top, sides and end, unless naturally durable or preservative-treated wood is used.

**2304.11.2.6 Wood siding.** Clearance between wood siding and earth on the exterior of a building shall not be less than 6 inches (152 mm) or less than 2 inches (51 mm) vertical from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather except where siding, sheathing and wall framing are of naturally durable or preservative-treated wood.

**2304.11.2.7 Posts or columns.** Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or preservative-treated wood.

**Exceptions:**

1. Posts or columns that are either exposed to the weather or located in basements or cellars, supported by concrete piers or metal pedestals projected at least 1 inch (25 mm) above the slab or deck and 6 inches (152 mm) above exposed earth, and are separated therefrom by an impervious moisture barrier.
2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than 8 inches (203 mm) from exposed ground, and are separated therefrom by an impervious moisture barrier.

**2304.11.2.8 Separate wood framing.** *[SPCB] Correct the conditions in frame and stucco walls and similar appurtenant construction so that the wood framing is separate from the main structure by a complete concrete or masonry plug with no voids that will allow infestations to enter the structure from the wall. If there is no plug, the foundation shall be 2 inches (51 mm) or more above the grade levels and at least as high as the*

*adjoining slabs or 4-inch (102 mm) concrete barrier seat off installed.*

**2304.11.3 Laminated timbers.** The portions of glued-laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not fully protected from moisture by a roof, eave or similar covering shall be pressure treated with preservative or be manufactured from naturally durable or preservative-treated wood.

**2304.11.4 Wood in contact with the ground or fresh water.** Wood used in contact with the ground (exposed earth) in the locations specified in Sections 2304.11.4.1 and 2304.11.4.2 shall be naturally durable (species for both decay and termite resistance) or preservative treated using water-borne preservatives in accordance with AWP A U1 (Commodity Specifications A or F) for soil or fresh water use.

**Exception:** Untreated wood is permitted where such wood is continuously and entirely below the ground-water level or submerged in fresh water.

**2304.11.4.1 Posts or columns.** Posts and columns supporting permanent structures that are embedded in concrete that is in direct contact with the earth, embedded in concrete that is exposed to the weather or in direct contact with the earth shall be of preservative-treated wood.

**2304.11.4.2 Wood structural members.** Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier.

**2304.11.5 Supporting member for permanent appurtenances.** Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.

**Exception:** When a building is located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use durable materials where the structure is exposed to the weather.

**2304.11.6 Termite protection.** In geographical areas where hazard of termite damage is known to be very heavy, wood floor framing in the locations specified in Section 2304.11.2.1 and exposed framing of exterior decks or balconies shall be of naturally durable species (termite resistant) or preservative treated in accordance with AWP A U1 for the species, product preservative and end use or provided with approved methods of termite protection.

**2304.11.7 Wood used in retaining walls and cribs.** Wood installed in retaining or crib walls shall be preservative treated in accordance with AWP A U1 (Commodity Specifications A or F) for soil and fresh water use.

**2304.11.8 Attic ventilation.** For attic ventilation, see Section 1203.2.

**2304.11.9 Under-floor ventilation (crawl space).** For under-floor ventilation (crawl space), see Section 1203.3.

**2304.11.10 Earth fills. [SPCB]** *Separate the earth fills such as under porches or paving from all woodwork by concrete, masonry, good quality cement plaster or other material approved by local building codes. Chemical treatment of earth fills is considered adequate if the foundation adjoining the fill meets standards of the current building codes.*

**2304.12 Long-term loading.** Wood members supporting concrete, masonry or similar materials shall be checked for the effects of long-term loading using the provisions of the AF&PA NDS. The total deflection, including the effects of long-term loading, shall be limited in accordance with Section 1604.3.1 for these supported materials.

**Exception:** Horizontal wood members supporting masonry or concrete nonstructural floor or roof surfacing not more than 4 inches (102 mm) thick need not be checked for long-term loading.

## SECTION 2305 GENERAL DESIGN REQUIREMENTS FOR LATERAL FORCE-RESISTING SYSTEMS

**2305.1 General.** Structures using wood-frame shear walls or wood-frame diaphragms to resist wind, seismic or other lateral loads shall be designed and constructed in accordance with AF&PA SDPWS and the applicable provisions of Sections 2305, 2306 and 2307.

**2305.1.1 Openings in shear panels.** Openings in shear panels that materially affect their strength shall be detailed on the plans, and shall have their edges adequately reinforced to transfer all shearing stresses.

**2305.1.2 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4]** *The following limitations shall apply:*

1. *Straight-sheathed horizontal lumber diaphragms are not permitted.*
2. *Gypsum-based sheathing shear walls and portland cement plaster shear walls are not permitted.*
3. *shear wall foundation anchor bolt washers shall be provided in accordance with AF&PA SDPWS Section 4.3.6.4.3. The exception to AF&PA SDPWS Section 4.3.6.4.3 shall not apply.*
4. *Wood structural panel shear walls and diaphragms using staples as fasteners are not permitted.*

5. Unblocked shear walls are not permitted.

6. Any wood structural panel sheathing used for shear walls that are part of the seismic force-resisting system shall be applied directly to framing members.

7. Single and double diagonally sheathed lumber walls shall not be used to resist seismic forces.

**2305.2 Diaphragm deflection.** The deflection of wood-frame diaphragms shall be determined in accordance with AF&PA SDPWS. The deflection ( $\Delta$ ) of a blocked wood structural panel diaphragm uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-1. If not uniformly fastened, the constant 0.188 (For SI: 1/1627) in the third term shall be modified by an approved method.

**Exception:** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] Section 2305.2 is not permitted by DSA.

$$\Delta = \frac{5vL^3}{8EAb} + \frac{vL}{4Gt} + 0.122Le_n + \frac{\Sigma(\Delta_c X)}{2b} \quad \text{(Equation 23-1)}$$

$$\text{For SI: } \Delta = \frac{0.052vL^3}{EAb} + \frac{vL}{4Gt} + \frac{Le_n}{1627} + \frac{\Sigma(\Delta_c X)}{2b}$$

where:

$A$  = Area of chord cross section, in square inches ( $\text{mm}^2$ ).

$b$  = Diaphragm width, in feet (mm).

$E$  = Elastic modulus of chords, in pounds per square inch ( $\text{N/mm}^2$ ).

$e_n$  = Staple deformation, in inches (mm) [see Table 2305.2(1)].

$Gt$  = Panel rigidity through the thickness, in pounds per inch ( $\text{N/mm}$ ) of panel width or depth [see Table 2305.2(2)].

$L$  = Diaphragm length, in feet (mm).

$v$  = Maximum shear due to design loads in the direction under consideration, in pounds per linear foot (plf) ( $\text{N/mm}$ ).

$\Delta$  = The calculated deflection, in inches (mm).

$\Sigma(\Delta_c X)$  = Sum of individual chord-splice slip values on both sides of the diaphragm, each multiplied by its distance to the nearest support.

**TABLE 2305.2(1)**  
 **$e_n$  VALUES (inches) FOR USE IN CALCULATING DIAPHRAGM AND SHEAR WALL DEFLECTION DUE TO FASTENER SLIP (Structural I)<sup>a, c</sup>**

LOAD PER FASTENER <sup>b</sup> (pounds)	FASTENER DESIGNATIONS
	14-Ga staple x 2 inches long
60	0.011
80	0.018
100	0.028
120	0.04
140	0.053
160	0.068

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

a. Increase  $e_n$  values 20 percent for plywood grades other than Structural I.

b. Load per fastener = maximum shear per foot divided by the number of fasteners per foot at interior panel edges.

c. Decrease  $e_n$  values 50 percent for seasoned lumber (moisture content < 19 percent).

**2305.3 Shear wall deflection.** The deflection of wood-frame shear walls shall be determined in accordance with AF&PA SDPWS. The deflection ( $\Delta$ ) of a blocked wood structural panel shear wall uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-2.

**Exception:** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] Section 2305.3 is not permitted by DSA.

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b} \quad \text{(Equation 23-2)}$$

$$\text{For SI: } \Delta = \frac{vh^3}{3EAb} + \frac{vh}{Gt} + \frac{he_n}{407.6} + d_a \frac{h}{b}$$

where:

$A$  = Area of boundary element cross section in square inches ( $\text{mm}^2$ ) (vertical member at shear wall boundary).

$b$  = Wall width, in feet (mm).

$d_a$  = Vertical elongation of overturning anchorage (including fastener slip, device elongation, anchor rod elongation, etc.) at the design shear load ( $v$ ).

$E$  = Elastic modulus of boundary element (vertical member at shear wall boundary), in pounds per square inch ( $\text{N/mm}^2$ ).

$e_n$  = Staple deformation, in inches (mm) [see Table 2305.2(1)].

$Gt$  = Panel rigidity through the thickness, in pounds per inch ( $\text{N/mm}$ ) of panel width or depth [see Table 2305.2(2)].

$h$  = Wall height, in feet (mm).

$v$  = Maximum shear due to design loads at the top of the wall, in pounds per linear foot ( $\text{N/mm}$ ).

$\Delta$  = The calculated deflection, in inches (mm).

**TABLE 2305.2(2)**  
**VALUES OF  $G_t$  FOR USE IN CALCULATING DEFLECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS AND DIAPHRAGMS**

PANEL TYPE	SPAN RATING	VALUES OF $G_t$ (lb/in. panel depth or width)							
		OTHER				STRUCTURAL I			
		3-ply Plywood	4-ply Plywood	5-ply Plywood <sup>a</sup>	OSB	3-ply Plywood	4-ply Plywood	5-ply Plywood <sup>a</sup>	OSB
Sheathing	24/0	25,000	32,500	37,500	77,500	32,500	42,500	41,500	77,500
	24/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	32/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	40/20	28,500	37,000	43,000	88,500	37,000	48,000	47,500	88,500
	48/24	31,000	40,500	46,500	96,000	40,500	52,500	51,000	96,000
Single Floor	16 o.c.	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	20 o.c.	28,000	36,500	42,000	87,000	36,500	47,500	46,000	87,000
	24 o.c.	30,000	39,000	45,000	93,000	39,000	50,500	49,500	93,000
	32 o.c.	36,000	47,000	54,000	110,000	47,000	61,000	59,500	110,000
	48 o.c.	50,500	65,500	76,000	155,000	65,500	85,000	83,500	155,000

	Thickness (in.)	OTHER			STRUCTURAL I		
		A-A, A-C	Marine	All Other Grades	A-A, A-C	Marine	All Other Grades
Sanded Plywood	1/4	24,000	31,000	24,000	31,000	31,000	31,000
	11/32	25,500	33,000	25,500	33,000	33,000	33,000
	3/8	26,000	34,000	26,000	34,000	34,000	34,000
	15/32	38,000	49,500	38,000	49,500	49,500	49,500
	1/2	38,500	50,000	38,500	50,000	50,000	50,000
	19/32	49,000	63,500	49,000	63,500	63,500	63,500
	5/8	49,500	64,500	49,500	64,500	64,500	64,500
	23/32	50,500	65,500	50,500	65,500	65,500	65,500
	3/4	51,000	66,500	51,000	66,500	66,500	66,500
	7/8	52,500	68,500	52,500	68,500	68,500	68,500
	1	73,500	95,500	73,500	95,500	95,500	95,500
	1 1/8	75,000	97,500	75,000	97,500	97,500	97,500

For SI: 1 inch = 25.4 mm, 1 pound/inch = 0.1751 N/mm.

a. Applies to plywood with five or more layers; for five-ply/three-layer plywood, use values for four ply.

## SECTION 2306 ALLOWABLE STRESS DESIGN

**2306.1 Allowable stress design.** The design and construction of wood elements in structures using allowable stress design shall be in accordance with the following applicable standards:

### American Forest & Paper Association.

NDS	National Design Specification for Wood Construction
SDPWS	Special Design Provisions for Wind and Seismic

### American Institute of Timber Construction.

AITC 104	Typical Construction Details
AITC 110	Standard Appearance Grades for Structural Glued Laminated Timber
AITC 113	Standard for Dimensions of Structural Glued Laminated Timber
AITC 117	Standard Specifications for Structural Glued Laminated Timber of Softwood Species

AITC 119      Standard Specifications for Structural Glued Laminated Timber of Hardwood Species

ANSI/AITC A190.1      Structural Glued Laminated Timber

AITC 200      Inspection Manual

### American Society of Agricultural and Biological Engineers.

ASABE EP 484.2	Diaphragm Design of Metal-clad, Post-Frame Rectangular Buildings
ASABE EP 486.1	Shallow Post Foundation Design
ASABE 559	Design Requirements and Bending Properties for Mechanically Laminated Columns

### APA—The Engineered Wood Association.

Panel Design Specification
Plywood Design Specification Supplement 1— Design & Fabrication of Plywood Curved Panel
Plywood Design Specification Supplement 2— Design & Fabrication of Glued Plywood-lumber Beams

Plywood Design Specification Supplement 3—  
Design & Fabrication of Plywood Stressed-skin Panels

Plywood Design Specification Supplement 4—  
Design & Fabrication of Plywood Sandwich Panels

Plywood Design Specification Supplement 5—  
Design & Fabrication of All-plywood Beams

EWS T300	Glulam Connection Details
EWS S560	Field Notching and Drilling of Glued Laminated Timber Beams
EWS S475	Glued Laminated Beam Design Tables
EWS X450	Glulam in Residential Construction
EWS X440	Product and Application Guide: Glulam
EWS R540	Builders Tips: Proper Storage and Handling of Glulam Beams

**TABLE 2306.1.4**  
**ALLOWABLE LOADS FOR LUMBER DECKING**

PATTERN	ALLOWABLE AREA LOAD <sup>a, b</sup>	
	Flexure	Deflection
Simple span	$\sigma_b = \frac{8F_b'd^2}{l^26}$	$\sigma_\Delta = \frac{384\Delta E'd^3}{5l^412}$
Two-span continuous	$\sigma_b = \frac{8F_b'd^2}{l^26}$	$\sigma_\Delta = \frac{185\Delta E'd^3}{l^412}$
Combination simple- and two-span continuous	$\sigma_b = \frac{8F_b'd^2}{l^26}$	$\sigma_\Delta = \frac{131\Delta E'd^3}{l^412}$
Cantilevered pieces intermixed	$\sigma_b = \frac{20F_b'd^2}{3l^26}$	$\sigma_\Delta = \frac{105\Delta E'd^3}{l^412}$
<b>Controlled random layout</b>		
Mechanically laminated decking	$\sigma_b = \frac{20F_b'd^2}{3l^26}$	$\sigma_\Delta = \frac{100\Delta E'd^3}{l^412}$
2-inch decking	$\sigma_b = \frac{20F_b'd^2}{3l^26}$	$\sigma_\Delta = \frac{100\Delta E'd^3}{l^412}$
3-inch and 4-inch decking	$\sigma_b = \frac{20F_b'd^2}{3l^26}$	$\sigma_\Delta = \frac{116\Delta E'd^3}{l^412}$

For SI: 1 inch = 25.4 mm.

a.  $\sigma_b$  = Allowable total uniform load limited by bending.

$\sigma_\Delta$  = Allowable total uniform load limited by deflection.

b.  $d$  = Actual decking thickness.

$l$  = Span of decking.

$F_b'$  = Allowable bending stress adjusted by applicable factors.

$E'$  = Modulus of elasticity adjusted by applicable factors.

## Truss Plate Institute, Inc.

TPI 1

National Design Standard for Metal  
Plate Connected Wood Truss Construc-  
tion

**2306.1.1 Joists and rafters.** The design of rafter spans is permitted to be in accordance with the *AF&PA Span Tables for Joists and Rafters*.

**2306.1.2 Plank and beam flooring.** The design of plank and beam flooring is permitted to be in accordance with the *AF&PA Wood Construction Data No. 4*.

**2306.1.3 Treated wood stress adjustments.** The allowable unit stresses for preservative-treated wood need no adjustment for treatment, but are subject to other adjustments.

The allowable unit stresses for fire-retardant-treated wood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and the redrying process. Other adjustments are applicable except that the impact load duration shall not apply.

**2306.1.4 Lumber decking.** The capacity of lumber decking arranged according to the patterns described in Section 2304.8.2 shall be the lesser of the capacities determined for flexure and deflection according to the formulas in Table 2306.1.4.

**2306.2 Wood-frame diaphragms.** Wood-frame diaphragms shall be designed and constructed in accordance with AF&PA SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AF&PA SDPWS shall be met and the allowable shear values set forth in Table 2306.2(1) or 2306.2(2) shall be permitted. The allowable shear values in Tables 2306.2(1) and 2306.2(2) are permitted to be increased 40 percent for wind design.

**Exception:** [DSA-SS, DSA-SS/CC and OSHPD 1, 2 & 4] Wood structural panel diaphragms using staples as fasteners are not permitted by DSA and OSHPD.

**2306.2.1 Gypsum board diaphragm ceilings.** Gypsum board diaphragm ceilings shall be in accordance with Section 2508.5.

**2306.3 Wood-frame shear walls.** Wood-frame shear walls shall be designed and constructed in accordance with AF&PA SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AF&PA SDPWS shall be met and the allowable shear values set forth in Table 2306.3(1), 2306.3(2) or 2306.3(3) shall be permitted. The allowable shear values in Tables 2306.3(1) and 2306.3(2) are permitted to be increased 40 percent for wind design. Panels complying with ANSI/APA PRP-210 shall be permitted to use design values for Plywood Siding in the AF&PA SDPWS.

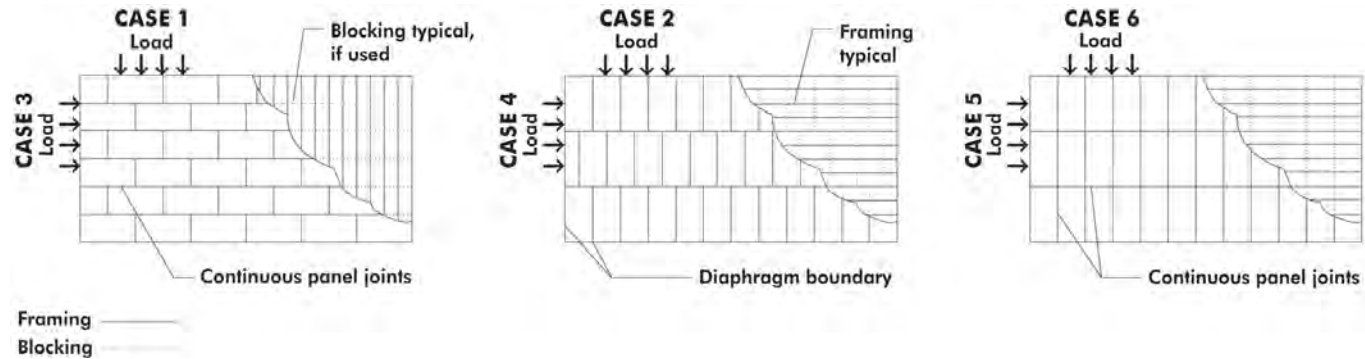
**Exception:** [DSA-SS & DSA-SS/CC and OSHPD 1, 2 & 4] Wood structural panel shear walls using staples as fasteners are not permitted by DSA and OSHPD.

TABLE 2306.2(1)  
ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS UTILIZING STAPLES  
WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE<sup>a</sup> FOR WIND OR SEISMIC LOADING<sup>i</sup>

PANEL GRADE	STAPLE LENGTH AND GAGE <sup>d</sup>	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES <sup>e</sup> (inches)	BLOCKED DIAPHRAGMS					UNBLOCKED DIAPHRAGMS	
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5, 6) <sup>b</sup>					Fasteners spaced 6 max. at supported edges <sup>b</sup>	
					6	4	2 1/2 <sup>c</sup>	2 <sup>c</sup>		Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6)
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4) <sup>b</sup>						
Structural I grades	1 1/2 16 gage	1	3/8	2	6	235	350	400	155	115	
				3	200	265	395	450	175	130	
				2	175	235	350	400	155	120	
			15/32	3	200	265	395	450	175	130	
			3/8	2	160	210	315	360	140	105	
				3	180	235	355	400	160	120	
Sheathing, single floor and other grades covered in DOC PS 1 and PS 2	1 1/2 16 gage	1	7/16	2	165	225	335	380	150	110	
				3	190	250	375	425	165	125	
			15/32	2	160	210	315	360	140	105	
				3	180	235	355	405	160	120	
			19/32	2	175	235	350	400	155	115	
				3	200	265	395	450	175	130	

(continued)

TABLE 2306.2(1)—continued  
 ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS UTILIZING STAPLES  
 WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE<sup>a</sup> FOR WIND OR SEISMIC LOADING<sup>f</sup>



For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. (2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Space fasteners maximum 12 inches o.c. along intermediate framing members (6 inches o.c. where supports are spaced 48 inches o.c.).
- Framing at adjoining panel edges shall be 3 inches nominal or wider.
- Staples shall have a minimum crown width of  $\frac{7}{16}$  inch and shall be installed with their crowns parallel to the long dimension of the framing members.
- The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.
- For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

**TABLE 2306.2(2)**  
**ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS**  
**UTILIZING MULTIPLE ROWS OF STAPLES (HIGH-LOAD DIAPHRAGMS) WITH FRAMING OF**  
**DOUGLAS FIR-LARCH OR SOUTHERN PINE<sup>a</sup> FOR WIND OR SEISMIC LOADING<sup>b, g, h</sup>**

PANEL GRADE <sup>c</sup>	STAPLE GAGE <sup>f</sup>	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER AT ADJOINING PANEL EDGES AND BOUNDARIES <sup>e</sup>	LINES OF FASTENERS	BLOCKED DIAPHRAGMS					
						Cases 1 and 2 <sup>d</sup>					
						Fastener Spacing Per Line at Boundaries (inches)					
						4	2 1/2	2			
						Fastener Spacing Per Line at Other Panel Edges (inches)					
						6	4	4	3	3	2
Structural I grades	14 gage staples	2	15/32	3	2	600	600	860	960	1,060	1,200
				4	3	860	900	1,160	1,295	1,295	1,400
			19/32	3	2	600	600	875	960	1,075	1,200
				4	3	875	900	1,175	1,440	1,475	1,795
Sheathing single floor and other grades covered in DOC PS 1 and PS 2	14 gage staples	2	15/32	3	2	540	540	735	865	915	1,080
				4	3	735	810	1,005	1,105	1,105	1,195
			19/32	3	2	600	600	865	960	1,065	1,200
				4	3	865	900	1,130	1,430	1,370	1,485
			23/32	4	3	865	900	1,130	1,490	1,430	1,545

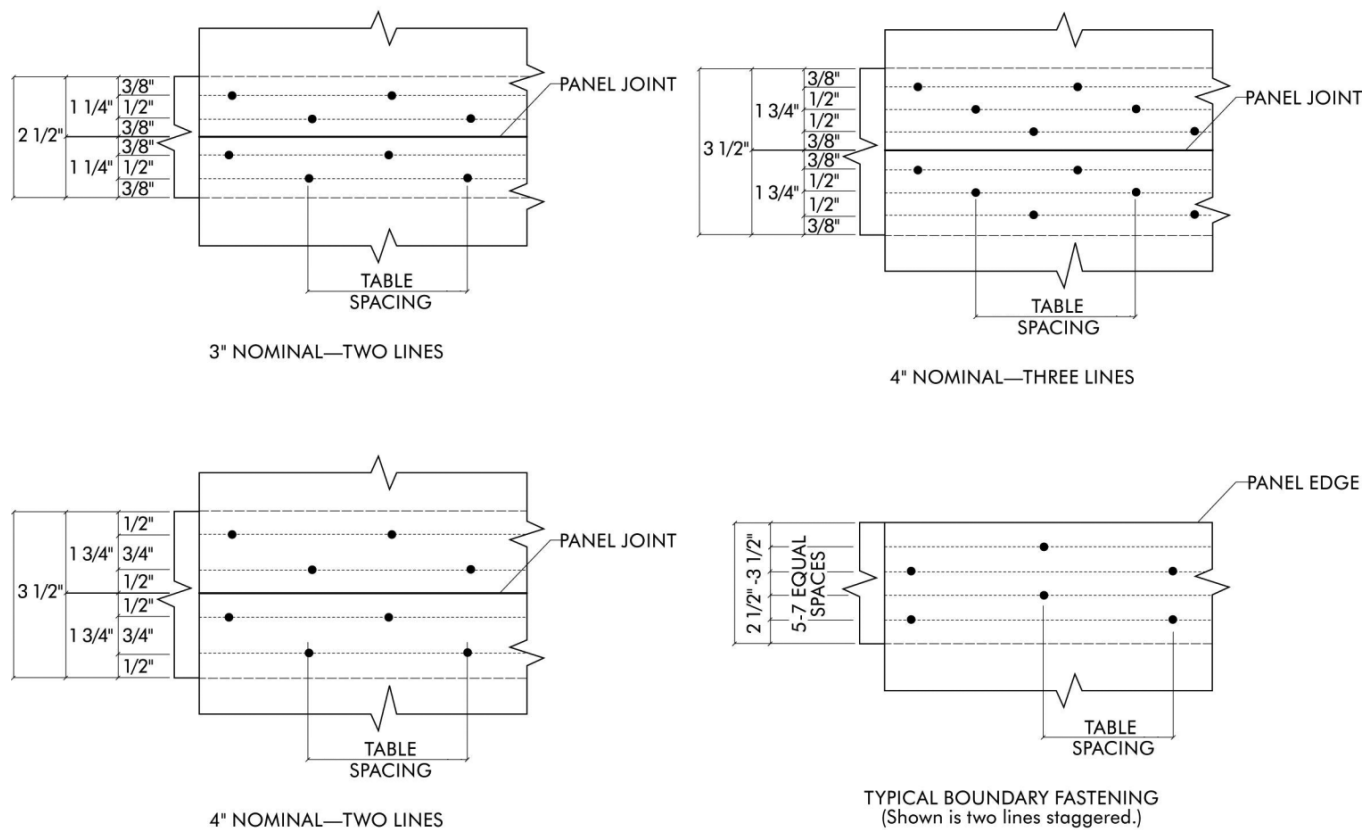
For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- For framing of other species: (1) Find specific gravity for species of framing lumber in AF&PA NDS. (2) For staples, find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Fastening along intermediate framing members: Space fasteners a maximum of 12 inches on center, except 6 inches on center for spans greater than 32 inches.
- Panels conforming to PS 1 or PS 2.
- This table gives shear values for Cases 1 and 2 as shown in Table 2306.2(1). The values shown are applicable to Cases 3, 4, 5 and 6 as shown in Table 2306.2(1), providing fasteners at all continuous panel edges are spaced in accordance with the boundary fastener spacing.
- The minimum nominal depth of framing members shall be 3 inches nominal. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.
- Staples shall have a minimum crown width of 7/16 inch, and shall be installed with their crowns parallel to the long dimension of the framing members.
- High-load diaphragms shall be subject to special inspection in accordance with Section 1705.5.1.
- For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

*(continued)*



TABLE 2306.2(2)—continued  
ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS  
UTILIZING MULTIPLE ROWS OF STAPLES (HIGH-LOAD DIAPHRAGMS) WITH FRAMING OF  
DOUGLAS FIR-LARCH OR SOUTHERN PINE FOR WIND OR SEISMIC LOADING



NOTE: SPACE PANEL END AND EDGE JOINT 1/8-INCH. REDUCE SPACING BETWEEN LINES OF NAILS AS NECESSARY TO MAINTAIN MINIMUM 3/8-INCH FASTENER EDGE MARGINS, MINIMUM SPACING BETWEEN LINES IS 3/8-INCH

**TABLE 2306.3(1)**  
**ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL SHEAR WALLS UTILIZING STAPLES WITH**  
**FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE<sup>a</sup> FOR WIND OR SEISMIC LOADING<sup>b, f, g, i</sup>**

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING				PANELS APPLIED OVER 1/2" OR 5/8" GYPSUM SHEATHING					
			Staple size <sup>h</sup>	Fastener spacing at panel edges (inches)				Staple size <sup>h</sup>	Fastener spacing at panel edges (inches)			
				6	4	3	2 <sup>d</sup>		6	4	3	2 <sup>d</sup>
Structural I sheathing	3/8	1	1 1/2 16 Gage	155	235	315	400	2 16 Gage	155	235	310	400
	7/16			170	260	345	440		155	235	310	400
	15/32			185	280	375	475		155	235	300	400
Sheathing, plywood siding <sup>e</sup> except Group 5 Species, ANSI/APA PRP 210 siding	5/16 <sup>c</sup> or 1/4 <sup>c</sup>	1	1 1/2 16 Gage	145	220	295	375	2 16 Gage	110	165	220	285
	3/8			140	210	280	360		140	210	280	360
	7/16			155	230	310	395		140	210	280	360
	15/32			170	255	335	430		140	210	280	360
	19/32		1 3/4 16 Gage	185	280	375	475	—	—	—	—	

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. (2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space fasteners maximum 6 inches on center along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches on center. For other conditions and panel thickness, space fasteners maximum 12 inches on center on intermediate supports.
- 3/8-inch panel thickness or siding with a span rating of 16 inches on center is the minimum recommended where applied directly to framing as exterior siding. For grooved panel siding, the nominal panel thickness is the thickness of the panel measured at the point of fastening.
- Framing at adjoining panel edges shall be 3 inches nominal or wider.
- Values apply to all-veneer plywood. Thickness at point of fastening on panel edges governs shear values.
- Where panels are applied on both faces of a wall and fastener spacing is less than 6 inches o.c. on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3 inches nominal or thicker at adjoining panel edges.
- In Seismic Design Category D, E or F, where shear design values exceed 350 pounds per linear foot, all framing members receiving edge fastening from abutting panels shall not be less than a single 3-inch nominal member, or two 2-inch nominal members fastened together in accordance with Section 2306.1 to transfer the design shear value between framing members. Wood structural panel joint and sill plate nailing shall be staggered at all panel edges. See AF&PA SDPWS for sill plate size and anchorage requirements.
- Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members.
- For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

**TABLE 2306.3(2)**  
**ALLOWABLE SHEAR VALUES (plf) FOR WIND OR SEISMIC LOADING ON SHEAR WALLS OF FIBERBOARD**  
**SHEATHING BOARD CONSTRUCTION UTILIZING STAPLES FOR TYPE V CONSTRUCTION ONLY<sup>a, b, c, d, e</sup>**

THICKNESS AND GRADE	FASTENER SIZE	ALLOWABLE SHEAR VALUE (pounds per linear foot) STAPLE SPACING AT PANEL EDGES (inches) <sup>a</sup>		
		4	3	2
1/2" or 25/32" Structural	No. 11 gage galvanized staple, 7/16" crown <sup>f</sup>	150	200	225
	No. 11 gage galvanized staple, 1" crown <sup>f</sup>	220	290	325

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- Fiberboard sheathing shall not be used to brace concrete or masonry walls.
- Panel edges shall be backed with 2-inch or wider framing of Douglas fir-larch or Southern pine. For framing of other species: (1) Find specific gravity for species of framing lumber in AF&PA NDS. (2) For staples, multiply the shear value from the table above by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Values shown are for fiberboard sheathing on one side only with long panel dimension either parallel or perpendicular to studs.
- Fastener shall be spaced 6 inches on center along intermediate framing members.
- Values are not permitted in Seismic Design Category D, E or F.
- Staple length shall not be less than 1 1/2 inches for 25/32-inch sheathing or 1 1/4 inches for 1/2-inch sheathing.

**TABLE 2306.3(3)**  
**ALLOWABLE SHEAR VALUES FOR WIND OR SEISMIC FORCES FOR SHEAR WALLS OF LATH AND PLASTER OR GYPSUM BOARD**  
**WOOD FRAMED WALL ASSEMBLIES UTILIZING STAPLES**

TYPE OF MATERIAL	THICKNESS OF MATERIAL	WALL CONSTRUCTION	STAPLE SPACING <sup>b</sup> MAXIMUM (inches)	SHEAR VALUE <sup>a, c</sup> (plf)	MINIMUM STAPLE SIZE <sup>f, g</sup>
1. Expanded metal or woven wire lath and Portland cement plaster	$\frac{7}{8}$ "	Unblocked	6	180	No. 16 gage galv. staple, $\frac{7}{8}$ " legs
2. Gypsum lath, plain or perforated	$\frac{3}{8}$ " lath and $\frac{1}{2}$ " plaster	Unblocked	5	100	No. 16 gage galv. staple, $1\frac{1}{8}$ " long
3. Gypsum sheathing	$\frac{1}{2}$ " $\times$ 2' $\times$ 8'	Unblocked	4	75	No. 16 gage galv. staple, $1\frac{3}{4}$ " long
	$\frac{1}{2}$ " $\times$ 4'	Blocked <sup>d</sup> Unblocked	4 7	175 100	
4. Gypsum board, gypsum veneer base or water-resistant gypsum backing board	$\frac{1}{2}$ "	Unblocked <sup>d</sup>	7	75	No. 16 gage galv. staple, $1\frac{1}{2}$ " long
		Unblocked <sup>d</sup>	4	110	
		Unblocked	7	100	
		Unblocked	4	125	
		Blocked <sup>e</sup>	7	125	
		Blocked <sup>e</sup>	4	150	
	$\frac{5}{8}$ "	Unblocked <sup>d</sup>	7	115	No. 16 gage galv. staple, $1\frac{1}{2}$ " legs, $1\frac{5}{8}$ " long
			4	145	
		Blocked <sup>e</sup>	7	145	
			4	175	
		Blocked <sup>e</sup> Two-ply	Base ply: 9 Face ply: 7	250	No. 16 gage galv. staple $1\frac{5}{8}$ " long No. 15 gage galv. staple, $2\frac{1}{4}$ " long

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per foot = 14.5939 N/m.

- These shear walls shall not be used to resist loads imposed by masonry or concrete walls (see AF & PA SDPWS). Values shown are for short-term loading due to wind or seismic loading. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7. Values shown shall be reduced 25 percent for normal loading.
- Applies to fastening at studs, top and bottom plates and blocking.
- Except as noted, shear values are based on a maximum framing spacing of 16 inches on center.
- Maximum framing spacing of 24 inches on center.
- All edges are blocked, and edge fastening is provided at all supports and all panel edges.
- Staples shall have a minimum crown width of  $\frac{7}{16}$  inch, measured outside the legs, and shall be installed with their crowns parallel to the long dimension of the framing members.
- Staples for the attachment of gypsum lath and woven-wire lath shall have a minimum crown width of  $\frac{3}{4}$  inch, measured outside the legs.

## SECTION 2307

### LOAD AND RESISTANCE FACTOR DESIGN

**2307.1 Load and resistance factor design.** The design and construction of wood elements and structures using load and resistance factor design shall be in accordance with AF&PA NDS and AF&PA SDPWS.

## SECTION 2308

### CONVENTIONAL LIGHT-FRAME CONSTRUCTION

**2308.1 General.** The requirements of this section are intended for conventional light-frame construction. Other methods are permitted to be used, provided a satisfactory design is submitted showing compliance with other provisions of this code. Interior nonload-bearing partitions, ceilings and curtain walls of conventional light-frame construction are not subject to the limitations of this section. Alternatively, compliance with AF&PA WFCM shall be permitted subject to the limitations therein and the limitations of this code. Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three

stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *California Residential Code*.

**2308.1.1 Portions exceeding limitations of conventional construction.** When portions of a building of otherwise conventional construction exceed the limits of Section 2308.2, these portions and the supporting load path shall be designed in accordance with accepted engineering practice and the provisions of this code. For the purposes of this section, the term "portions" shall mean parts of buildings containing volume and area such as a room or a series of rooms.

**2308.2 Limitations.** Buildings are permitted to be constructed in accordance with the provisions of conventional light-frame construction, subject to the following limitations, and to further limitations of Sections 2308.11 and 2308.12.

- Buildings shall be limited to a maximum of three stories above grade plane. For the purposes of this section,

for buildings assigned to Seismic Design Category D or E, cripple stud walls shall be considered to be a story.

**Exception:** Solid blocked cripple walls not exceeding 14 inches (356 mm) in height need not be considered a story.

2. Maximum floor-to-floor height shall not exceed 11 feet, 7 inches (3531 mm). Bearing wall height shall not exceed a stud height of 10 feet (3048 mm).
3. Loads as determined in Chapter 16 shall not exceed the following:

- 3.1. Average dead loads shall not exceed 15 psf (718 N/m<sup>2</sup>) for combined roof and ceiling, exterior walls, floors and partitions.

**Exceptions:**

1. Subject to the limitations of Sections 2308.11.2 and 2308.12.2, stone or masonry veneer up to the lesser of 5 inches (127 mm) thick or 50 psf (2395 N/m<sup>2</sup>) and installed in accordance with Chapter 14 is permitted to a height of 30 feet (9144 mm) above a noncombustible foundation, with an additional 8 feet (2438 mm) permitted for gable ends.
2. Concrete or masonry fireplaces, heaters and chimneys shall be permitted in accordance with the provisions of this code.
- 3.2. Live loads shall not exceed 40 psf (1916 N/m<sup>2</sup>) for floors.
- 3.3. Ground snow loads shall not exceed 50 psf (2395 N/m<sup>2</sup>).
4.  $V_{asd}$  as determined in accordance with Section 1609.3.1 shall not exceed 100 miles per hour (mph) (44 m/s) (3-second gust).
 

**Exception:**  $V_{asd}$  as determined in accordance with Section 1609.3.1 shall not exceed 110 mph (48.4 m/s) (3-second gust) for buildings in Exposure Category B that are not located in a hurricane-prone region.
5. Roof trusses and rafters shall not span more than 40 feet (12 192 mm) between points of vertical support.
6. The use of the provisions for conventional light-frame construction in this section shall not be permitted for Risk Category IV buildings assigned to Seismic Design Category B, C, D, E or F.
7. Conventional light-frame construction is limited in irregular structures assigned to Seismic Design Category D or E, as specified in Section 2308.12.6.
8. *[DSA-SS & DSA-SS/CC and OSHPD 2] The use of conventional light-frame construction provisions in this section is permitted, subject to the following conditions:*
  - 8.1. *The design and construction shall also comply with Section 2304 and Section 2305.*

8.2. *In conjunction with the use of provisions in Section 2308.3 (Braced Wall Lines), engineering analysis shall be furnished that demonstrates compliance of lateral-force-resisting systems with Section 2305.*

8.3. *In addition to the use of provisions in Section 2308.8 (Floor Joists), engineering analysis shall be furnished that demonstrates compliance of floor framing elements and connections with Section 2301.2, Item 1 or 2.*

8.4. *In addition to the use of provisions in Section 2308.9 (Wall Framing), engineering analysis shall be furnished that demonstrates compliance of wall framing elements and connections with Section 2301.2, Item 1 or 2.*

8.5. *In addition to the use of provisions in Section 2308.10 (Roof and Ceiling Framing), engineering analysis shall be furnished demonstrating compliance of roof and ceiling framing elements and connections with Section 2301.2, Item 1 or 2.*

**2308.2.1 Nominal design wind speed greater than 100 mph (3-second gust).** Where  $V_{asd}$  as determined in accordance with Section 1609.3.1 exceeds 100 mph (3-second gust), the provisions of either AF&PA WFCM or ICC 600 are permitted to be used. Wind speeds in Figures 1609A, 1609B, and 1609C shall be converted in accordance with Section 1609.3.1 for use with AF&PA WFCM or ICC 600.

**2308.2.2 Buildings in Seismic Design Category B, C, D or E.** Buildings of conventional light-frame construction and assigned to Seismic Design Category B or C shall comply with the additional requirements in Section 2308.11.

Buildings of conventional light-frame construction and assigned to Seismic Design Category D or E shall comply with the additional requirements in Section 2308.12.

**2308.3 Braced wall lines.** Buildings shall be provided with exterior and interior braced wall lines as described in Section 2308.9.3 and installed in accordance with Sections 2308.3.1 through 2308.3.4.

**2308.3.1 Spacing.** Spacing of braced wall lines shall not exceed 35 feet (10 668 mm) o.c. in both the longitudinal and transverse directions in each story.

**2308.3.2 Braced wall line connections.** Wind and seismic lateral forces shall be transferred from the roof and floor diaphragms to braced wall lines and from the braced wall lines in upper stories to the braced wall lines in the story below in accordance with Sections 2308.3.2.1 and 2308.3.2.2.

**2308.3.2.1 Bottom plate connection.** Braced wall line bottom plates shall be connected to joists or full-depth blocking below in accordance with Table 2304.9.1, Item 6, or to foundations in accordance with Section 2308.3.3.

**2308.3.2.2 Top plate connection.** Where joists and/or rafters are used, braced wall line top plates shall be fas-

tened over the full length of the braced wall line to joists, rafters, rimboards or blocking above in accordance with Table 2304.9.1, Items 11, 12, 15 or 19, as applicable, based on the orientation of the joists or rafters to the braced wall line. Blocking at joists with walls above shall be equal to the depth of the joist at the braced wall line. Blocking at rafters need not be full depth but shall extend to within 2 inches (51 mm) from the roof sheathing above. Blocking shall be a minimum of 2 inches (51 mm) nominal thickness and shall be fastened to the braced wall line top plate as specified in Table 2304.9.1, Item 11. Notching or drilling of holes in blocking in accordance with the requirements of Section 2308.8.2 or Section 2308.10.4.2 shall be permitted.

At exterior gable end walls braced wall panel sheathing in the top story shall be extended and fastened to roof framing where the spacing between parallel exterior braced wall lines is greater than 50 feet (15 240 mm).

Where roof trusses are used and are installed perpendicular to an exterior braced wall line, lateral forces shall be transferred from the roof diaphragm to the braced wall over the full length of the braced wall line by blocking of the ends of the trusses or by other approved methods providing equivalent lateral force transfer. Blocking shall be minimum 2 inches (51 mm) nominal thickness and shall extend to within 2 inches (51 mm) from the roof sheathing above and shall be fastened to the braced wall line top plate as specified in Table 2304.9.1, Item 11. Notching or drilling of holes in blocking in accordance with the requirements of Section 2308.8.2 or Section 2308.10.4.2 shall be permitted.

**2308.3.3 Sill anchorage.** Where foundations are required by Section 2308.3.4, braced wall line sills shall be anchored to concrete or masonry foundations. Such anchorage shall conform to the requirements of Section 2308.6 except that such anchors shall be spaced at not more than 4 feet (1219 mm) o.c. for structures over two stories above grade plane. The anchors shall be distributed along the length of the braced wall line. Other anchorage devices having equivalent capacity are permitted.

**2308.3.3.1 Anchorage to all-wood foundations.**

Where all-wood foundations are used, the force transfer from the braced wall lines shall be determined based on calculation and shall have a capacity greater than or equal to the connections required by Section 2308.3.3.

**2308.3.4 Braced wall line support.** Braced wall lines shall be supported by continuous foundations.

**Exception:** For structures with a maximum plan dimension not over 50 feet (15 240 mm), continuous foundations are required at exterior walls only.

**2308.4 Design of elements.** Combining of engineered elements or systems and conventionally specified elements or systems is permitted subject to the following limits:

**2308.4.1 Elements exceeding limitations of conventional construction.** When a building of otherwise conventional construction contains structural elements exceeding the limits of Section 2308.2, these elements and the supporting load path shall be designed in accordance with accepted engineering practice and the provisions of this code.

**2308.4.2 Structural elements or systems not described herein.** When a building of otherwise conventional construction contains structural elements or systems not described in Section 2308, these elements or systems shall be designed in accordance with accepted engineering practice and the provisions of this code. The extent of such design need only demonstrate compliance of the nonconventional elements with other applicable provisions of this code and shall be compatible with the performance of the conventionally framed system.

**2308.5 Connectors and fasteners.** Connectors and fasteners used in conventional construction shall comply with the requirements of Section 2304.9.

**2308.6 Foundation plates or sills.** Foundations and footings shall be as specified in Chapter 18. Foundation plates or sills resting on concrete or masonry foundations shall comply with Section 2304.3.1. Foundation plates or sills shall be bolted or anchored to the foundation with not less than  $\frac{1}{2}$ -inch-diameter (12.7 mm) steel bolts or approved anchors spaced to provide equivalent anchorage as the steel bolts. Bolts shall be embedded at least 7 inches (178 mm) into concrete or masonry, and spaced not more than 6 feet (1829 mm) apart. There shall be a minimum of two bolts or anchor straps per piece with one bolt or anchor strap located not more than 12 inches (305 mm) or less than 4 inches (102 mm) from each end of each piece. A properly sized nut and washer shall be tightened on each bolt to the plate.

**2308.7 Girders.** Girders for single-story construction or girders supporting loads from a single floor shall not be less than 4 inches by 6 inches (102 mm by 152 mm) for spans 6 feet (1829 mm) or less, provided that girders are spaced not more than 8 feet (2438 mm) o.c. Spans for built-up 2-inch (51 mm) girders shall be in accordance with Table 2308.9.5 or 2308.9.6. Other girders shall be designed to support the loads specified in this code. Girder end joints shall occur over supports.

Where a girder is spliced over a support, an adequate tie shall be provided. The ends of beams or girders supported on masonry or concrete shall not have less than 3 inches (76 mm) of bearing.

**TABLE 2308.8(1)**  
**FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES**  
**(Residential Sleeping Areas, Live Load = 30 psf, L/Δ = 360)**

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	12-6	16-6	21-0	25-7	12-6	16-6	21-0	25-7
	Douglas Fir-Larch	#1	12-0	15-10	20-3	24-8	12-0	15-7	19-0	22-0
	Douglas Fir-Larch	#2	11-10	15-7	19-10	23-0	11-6	14-7	17-9	20-7
	Douglas Fir-Larch	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Hem-Fir	SS	11-10	15-7	19-10	24-2	11-10	15-7	19-10	24-2
	Hem-Fir	#1	11-7	15-3	19-5	23-7	11-7	15-2	18-6	21-6
	Hem-Fir	#2	11-0	14-6	18-6	22-6	11-0	14-4	17-6	20-4
	Hem-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Southern Pine	SS	12-3	16-2	20-8	25-1	12-3	16-2	20-8	25-1
	Southern Pine	#1	12-0	15-10	20-3	24-8	12-0	15-10	20-3	24-8
	Southern Pine	#2	11-10	15-7	19-10	24-2	11-10	15-7	18-7	21-9
	Southern Pine	#3	10-5	13-3	15-8	18-8	9-4	11-11	14-0	16-8
	Spruce-Pine-Fir	SS	11-7	15-3	19-5	23-7	11-7	15-3	19-5	23-7
	Spruce-Pine-Fir	#1	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#2	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
16	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-0
	Douglas Fir-Larch	#1	10-11	14-5	18-5	21-4	10-8	13-6	16-5	19-1
	Douglas Fir-Larch	#2	10-9	14-1	17-2	19-11	9-11	12-7	15-5	17-10
	Douglas Fir-Larch	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	20-9	10-4	13-1	16-0	18-7
	Hem-Fir	#2	10-0	13-2	16-10	19-8	9-10	12-5	15-2	17-7
	Hem-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	17-11	21-4
	Southern Pine	#2	10-9	14-2	18-0	21-1	10-5	13-6	16-1	18-10
	Southern Pine	#3	9-0	11-6	13-7	16-2	8-1	10-3	12-2	14-6
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-4
	Spruce-Pine-Fir	#1	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
19.2	Douglas Fir-Larch	SS	10-8	14-1	18-0	21-10	10-8	14-1	18-0	21-0
	Douglas Fir-Larch	#1	10-4	13-7	16-9	19-6	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	10-1	12-10	15-8	18-3	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Hem-Fir	SS	10-1	13-4	17-0	20-8	10-1	13-4	17-0	20-7
	Hem-Fir	#1	9-10	13-0	16-4	19-0	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-5	12-5	15-6	17-1	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4

(continued)

**TABLE 2308.8(1)—continued**  
**FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES**  
 (Residential Sleeping Areas, Live Load = 30 psf,  $L/\Delta = 360$ )

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Southern Pine	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Southern Pine	#1	10-4	13-7	17-4	21-1	10-4	13-7	16-4	19-6
	Southern Pine	#2	10-1	13-4	16-5	19-3	9-6	12-4	14-8	17-2
	Southern Pine	#3	8-3	10-6	12-5	14-9	7-4	9-5	11-1	13-2
	Spruce-Pine-Fir	SS	9-10	13-0	16-7	20-2	9-10	13-0	16-7	19-6
	Spruce-Pine-Fir	#1	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
24	Douglas Fir-Larch	SS	9-11	13-1	16-8	20-3	9-11	13-1	16-2	18-9
	Douglas Fir-Larch	#1	9-7	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Hem-Fir	SS	9-4	12-4	15-9	19-2	9-4	12-4	15-9	18-5
	Hem-Fir	#1	9-2	12-0	14-8	17-0	8-6	10-9	13-1	15-2
	Hem-Fir	#2	8-9	11-4	13-10	16-1	8-0	10-2	12-5	14-4
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Southern Pine	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Southern Pine	#1	9-7	12-7	16-1	19-6	9-7	12-4	14-7	17-5
	Southern Pine	#2	9-4	12-4	14-8	17-2	8-6	11-0	13-1	15-5
	Southern Pine	#3	7-4	9-5	11-1	13-2	6-7	8-5	9-11	11-10
	Spruce-Pine-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-0	17-5
	Spruce-Pine-Fir	#1	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#2	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m<sup>2</sup>.

**TABLE 2308.8(2)**  
**FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES**  
 (Residential Living Areas, Live Load = 40 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas Fir-Larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas Fir-Larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas Fir-Larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-Fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	18-5	22-5
	Southern Pine	#2	10-9	14-2	18-0	21-9	10-9	14-2	16-11	19-10
	Southern Pine	#3	9-4	11-11	14-0	16-8	8-6	10-10	12-10	15-3
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-Pine-Fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas Fir-Larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas Fir-Larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-Fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-Fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern Pine	#1	9-11	13-1	16-9	20-4	9-11	13-1	16-4	19-6
	Southern Pine	#2	9-9	12-10	16-1	18-10	9-6	12-4	14-8	17-2
	Southern Pine	#3	8-1	10-3	12-2	14-6	7-4	9-5	11-1	13-2
	Spruce-Pine-Fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-Pine-Fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
19.2	Douglas Fir-Larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas Fir-Larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-Fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-Fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern Pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern Pine	#1	9-4	12-4	15-9	19-2	9-4	12-4	14-11	17-9
	Southern Pine	#2	9-2	12-1	14-8	17-2	8-8	11-3	13-5	15-8
	Southern Pine	#3	7-4	9-5	11-1	13-2	6-9	8-7	10-1	12-1
	Spruce-Pine-Fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-Pine-Fir	#1	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3

(continued)



**TABLE 2308.8(2)—continued**  
**FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES**  
**(Residential Living Areas, Live Load = 40 psf, L/Δ = 360)**

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
24	Douglas Fir-Larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas Fir-Larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas Fir-Larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas Fir-Larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-Fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10 <sup>a</sup>
	Hem-Fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-Fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern Pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-1
	Southern Pine	#1	8-8	11-5	14-7	17-5	8-8	11-3	13-4	15-11
	Southern Pine	#2	8-6	11-0	13-1	15-5	7-9	10-0	12-0	14-0
	Southern Pine	#3	6-7	8-5	9-11	11-10	6-0	7-8	9-1	10-9
	Spruce-Pine-Fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-Pine-Fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m<sup>2</sup>.

a. End bearing length shall be increased to 2 inches.

**2308.8 Floor joists.** Spans for floor joists shall be in accordance with Table 2308.8(1) or 2308.8(2). For other grades and for species, refer to the *AF&PA Span Tables for Joists and Rafters*.

**2308.8.1 Bearing.** Except where supported on a 1-inch by 4-inch (25.4 mm by 102 mm) ribbon strip and nailed to the adjoining stud, the ends of each joist shall not have less than 1½ inches (38 mm) of bearing on wood or metal, or less than 3 inches (76 mm) on masonry.

**2308.8.2 Framing details.** Joists shall be supported laterally at the ends and at each support by solid blocking except where the ends of the joists are nailed to a header, band or rim joist or to an adjoining stud or by other means. Solid blocking shall not be less than 2 inches (51 mm) in thickness and the full depth of the joist. Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

Joist framing from opposite sides of a beam, girder or partition shall be lapped at least 3 inches (76 mm) or the opposing joists shall be tied together in an approved manner.

Joists framing into the side of a wood girder shall be supported by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

**2308.8.2.1 Engineered wood products.** Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members or I-joists are not permitted except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

**2308.8.3 Framing around openings.** Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header joists more than 6 feet (1829 mm) long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition or wall. Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

**2308.8.4 Supporting bearing partitions.** Bearing partitions parallel to joists shall be supported on beams, girders, doubled joists, walls or other bearing partitions. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

**2308.8.5 Lateral support.** Floor, attic and roof framing with a nominal depth-to-thickness ratio greater than or equal to 5:1 shall have one edge held in line for the entire span. Where the nominal depth-to-thickness ratio of the framing member exceeds 6:1, there shall be one line of bridging for each 8 feet (2438 mm) of span, unless both edges of the member are held in line. The bridging shall consist of not less than 1-inch by 3-inch (25 mm by 76

mm) lumber, double nailed at each end, of equivalent metal bracing of equal rigidity, full-depth solid blocking or other approved means. A line of bridging shall also be required at supports where equivalent lateral support is not otherwise provided.

**2308.8.6 Structural floor sheathing.** Structural floor sheathing shall comply with the provisions of Section 2304.7.1.

**2308.8.7 Under-floor ventilation.** For under-floor ventilation, see Section 1203.3.

**2308.9 Wall framing.** Walls and partitions shall be constructed in accordance with the applicable provisions of Sections 2308.9.1 through 2308.9.4.2.

**2308.9.1 Size, height and spacing.** The size, height and spacing of studs shall be in accordance with Table 2308.9.1 except that utility-grade studs shall not be spaced more than 16 inches (406 mm) o.c., or support more than a roof and ceiling, or exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048 mm) for interior nonload-bearing walls. Studs shall be continuous from a support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

**Exception:** Jack studs, trimmer studs and cripple studs at openings in walls that comply with Table 2308.9.5.

**2308.9.2 Framing details.** Studs shall be placed with their wide dimension perpendicular to the wall. Not less than three studs shall be installed at each corner of an exterior wall.

**Exception:** At corners, two studs are permitted, provided wood spacers or backup cleats of  $\frac{3}{8}$ -inch-thick (9.5 mm) wood structural panel,  $\frac{3}{8}$ -inch (9.5 mm) Type M "Exterior Glue" particleboard, 1-inch-thick (25 mm) lumber or other approved devices that will serve as an adequate backing for the attachment of facing materials are used. Where fire-resistance ratings or shear values are involved, wood spacers, backup cleats or other devices shall not be used unless specifically approved for such use.

**2308.9.2.1 Top plates.** Bearing and exterior wall studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with other partitions. End joints in double top plates shall be offset at least 48 inches (1219 mm), and shall be nailed with not less than eight 16d face nails on each side of the joint. Plates shall be a nominal 2 inches (51 mm) in depth and have a width at least equal to the width of the studs.

**Exception:** A single top plate is permitted, provided the plate is adequately tied at joints, corners and intersecting walls by at least the equivalent of 3-inch by 6-inch (76 mm by 152 mm) by 0.036-inch-thick (0.914 mm) galvanized steel that is nailed to each wall or segment of wall by six 8d nails or equivalent, provided the rafters, joists or trusses are centered over the studs with a tolerance of no more than 1 inch (25 mm).

**2308.9.2.2 Top plates for studs spaced at 24 inches (610 mm).** Where bearing studs are spaced at 24-inch (610 mm) intervals and top plates are less than two 2-inch by 6-inch (51 mm by 152 mm) or two 3-inch by 4-inch (76 mm by 102 mm) members and where the floor joists, floor trusses or roof trusses that they support are spaced at more than 16-inch (406 mm) intervals, such joists or trusses shall bear within 5 inches (127 mm) of the studs beneath or a third plate shall be installed.

**2308.9.2.3 Nonbearing walls and partitions.** In nonbearing walls and partitions, studs shall be spaced not more than 28 inches (711 mm) o.c. and in interior nonbearing walls and partitions, are permitted to be set with the long dimension parallel to the wall. Interior nonbearing partitions shall be capped with no less than a single top plate installed to provide overlapping at corners and at intersections with other walls and partitions. The plate shall be continuously tied at joints by solid blocking at least 16 inches (406 mm) in length and equal in size to the plate or by  $\frac{1}{2}$ -inch by  $1\frac{1}{2}$ -inch (12.7 mm by 38 mm) metal ties with spliced sections fastened with two 16d nails on each side of the joint.

**TABLE 2308.9.1  
SIZE, HEIGHT AND SPACING OF WOOD STUDS**

STUD SIZE (inches)	BEARING WALLS				NONBEARING WALLS	
	Laterally unsupported stud height <sup>a</sup> (feet)	Supporting roof and ceiling only	Supporting one floor, roof and ceiling	Supporting two floors, roof and ceiling	Laterally unsupported stud height <sup>a</sup> (feet)	Spacing (inches)
	Spacing (inches)					
2 × 3 <sup>b</sup>	—	—	—	—	10	16
2 × 4	10	24	16	—	14	24
3 × 4	10	24	24	16	14	24
2 × 5	10	24	24	—	16	24
2 × 6	10	24	24	16	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by an analysis.

b. Shall not be used in exterior walls.

**2308.9.2.4 Plates or sills.** Studs shall have full bearing on a plate or sill not less than 2 inches (51 mm) in thickness having a width not less than that of the wall studs.

**2308.9.3 Bracing.** Braced wall lines shall consist of braced wall panels that meet the requirements for location, type and amount of bracing as shown in Figure 2308.9.3, specified in Table 2308.9.3(1) and are in line or offset from each other by not more than 4 feet (1219 mm). Braced wall panels shall start not more than 12½ feet (3810 mm) from each end of a braced wall line. Braced wall panels shall be clearly indicated on the plans. Construction of braced wall panels shall be by one of the following methods:

1. Nominal 1-inch by 4-inch (25 mm by 102 mm) continuous diagonal braces let into top and bottom plates and intervening studs, placed at an angle not more than 60 degrees (1.0 rad) or less than 45 degrees (0.79 rad) from the horizontal and attached to the framing in conformance with Table 2304.9.1.
2. Wood boards of 5⁄8 inch (15.9 mm) net minimum thickness applied diagonally on studs spaced not over 24 inches (610 mm) o.c.
3. Wood structural panel sheathing with a thickness not less than 3⁄8 inch (9.5 mm) for 16-inch (406 mm) or 24-inch (610 mm) stud spacing in accordance with Tables 2308.9.3(2) and 2308.9.3(3).
4. Fiberboard sheathing panels not less than 1⁄2 inch (12.7 mm) thick applied vertically or horizontally on studs spaced not over 16 inches (406 mm) o.c. where installed with fasteners in accordance with Section 2306.6 and Table 2306.6.
5. Gypsum board [sheathing 1⁄2-inch-thick (12.7 mm) by 4-feet-wide (1219 mm) wallboard or veneer base] on studs spaced not over 24 inches (610 mm) o.c. and nailed at 7 inches (178 mm) o.c. with nails as required by Table 2306.7.
6. Particleboard wall sheathing panels where installed in accordance with Table 2308.9.3(4).
7. Portland cement plaster on studs spaced 16 inches (406 mm) o.c. installed in accordance with Section 2510.
8. Hardboard panel siding where installed in accordance with Section 2303.1.6 and Table 2308.9.3(5).

For cripple wall bracing, see Section 2308.9.4.1. For Methods 2, 3, 4, 6, 7 and 8, each panel must be at least 48 inches (1219 mm) in length, covering three stud spaces where studs are spaced 16 inches (406 mm) apart and covering two stud spaces where studs are spaced 24 inches (610 mm) apart.

For Method 5, each panel must be at least 96 inches (2438 mm) in length where applied to one face of a panel and 48 inches (1219 mm) where applied to both faces. All vertical joints of panel sheathing shall occur over studs

and adjacent panel joints shall be nailed to common framing members. Horizontal joints shall occur over blocking or other framing equal in size to the studding except where waived by the installation requirements for the specific sheathing materials. Sole plates shall be nailed to the floor framing and top plates shall be connected to the framing above in accordance with Section 2308.3.2. Where joists are perpendicular to braced wall lines above, blocking shall be provided under and in line with the braced wall panels.

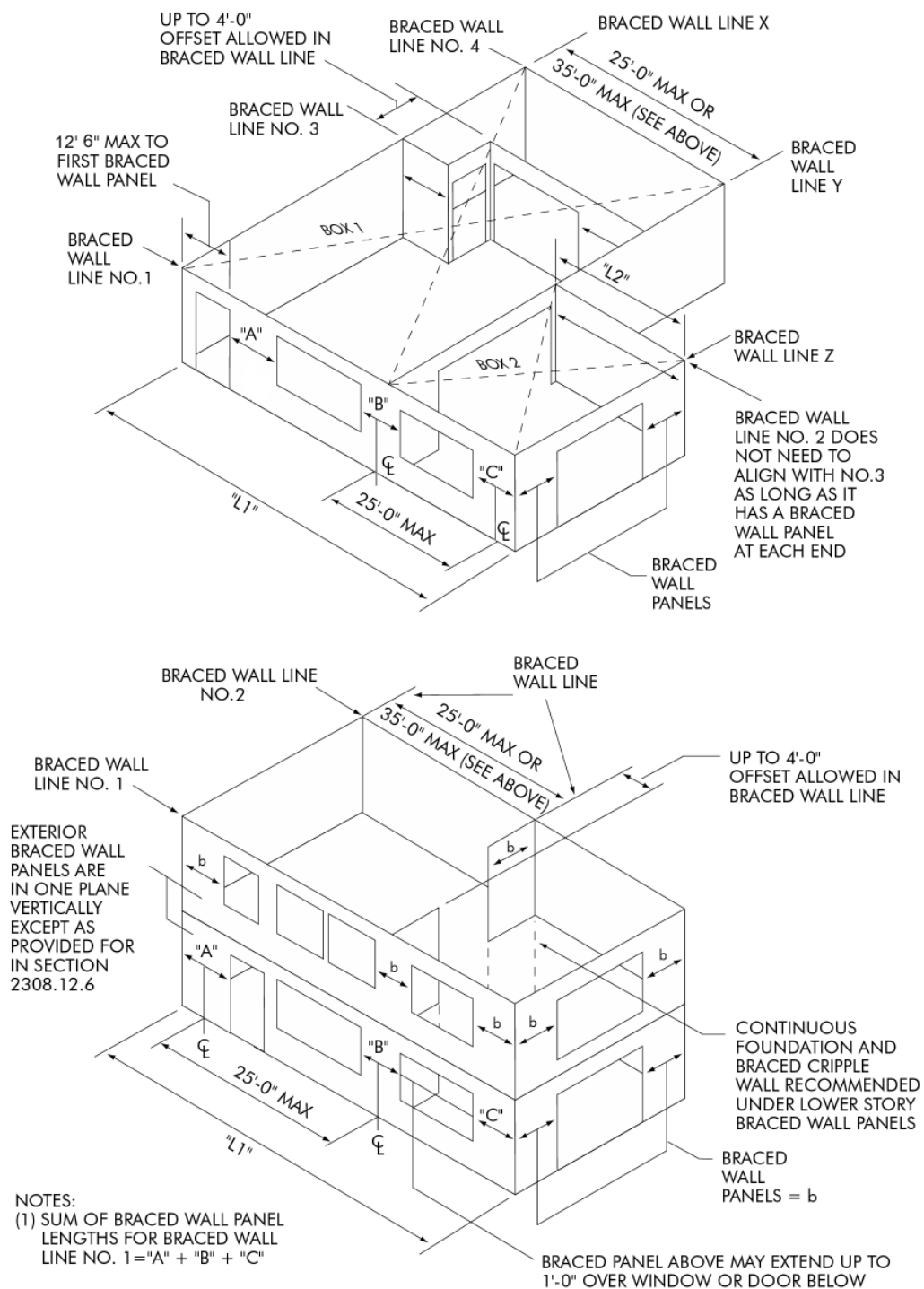
**2308.9.3.1 Alternative bracing.** Any bracing required by Section 2308.9.3 is permitted to be replaced by the following:

1. In one-story buildings, each panel shall have a length of not less than 2 feet 8 inches (813 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with 3⁄8-inch-minimum-thickness (9.5 mm) wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Table 2304.9.1 and blocked at wood structural panel edges. Two anchor bolts installed in accordance with Section 2308.6 shall be provided in each panel. Anchor bolts shall be placed at each panel outside quarter points. Each panel end stud shall have a tie-down device fastened to the foundation, capable of providing an approved uplift capacity of not less than 1,800 pounds (8006 N). The tie-down device shall be installed in accordance with the manufacturer's recommendations. The panels shall be supported directly on a foundation or on floor framing supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom.

Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

2. In the first story of two-story buildings, each wall panel shall be braced in accordance with Section 2308.9.3.1, Item 1, except that the wood structural panel sheathing shall be provided on both faces, three anchor bolts shall be placed at one-quarter points, and tie-down device uplift capacity shall not be less than 3,000 pounds (13 344 N).

SEISMIC DESIGN CATEGORY	MAXIMUM WALL SPACING (feet)	REQUIRED BRACING LENGTH, b
A, B and C	35'-0"	Table 2308.9.3(1) and Section 2308.9.3
D and E	25'-0"	Table 2308.12.4



For SI: 1 foot = 304.8 mm.

**FIGURE 2308.9.3  
BASIC COMPONENTS OF THE LATERAL BRACING SYSTEM**

**2308.9.3.2 Alternate bracing wall panel adjacent to a door or window opening.** Any bracing required by Section 2308.9.3 is permitted to be replaced by the following when used adjacent to a door or window opening with a full-length header:

1. In one-story buildings, each panel shall have a length of not less than 16 inches (406 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with a single layer of  $\frac{3}{8}$  inch (9.5 mm) minimum thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Figure 2308.9.3.2. The wood structural panel sheathing shall extend up over the solid sawn or glued-laminated header and shall be nailed in accordance with Figure 2308.9.3.2. A built-up header consisting of at least two  $2 \times 12$ s and fastened in accordance with Item 24 of Table 2304.9.1 shall be permitted to be used. A spacer, if used, shall be placed on the side of the built-up beam opposite the wood structural panel sheathing. The header shall extend between the inside faces of the first full-length outer studs of each panel. The clear span of the header between the inner studs of each panel shall be not less than 6 feet (1829 mm) and not more than 18 feet (5486 mm) in length. A strap with an uplift capacity of not less than 1,000 pounds (4,400 N) shall fasten the header to the inner studs opposite the sheathing. One anchor bolt not less than  $\frac{5}{8}$  inch (15.9 mm) diameter and installed in accordance with Section 2308.6 shall be provided in the center of each sill plate. The studs at each end of the panel shall have a tie-down device fastened to the foundation with an uplift capacity of not less than 4,200 pounds (18 480 N).

Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening. A strap with an uplift capacity of not less than 1,000 pounds (4400 N) shall fasten the header to the bearing studs. The bearing studs shall also have a tie-down device fastened to the foundation with an uplift capacity of not less than 1,000 pounds (4400 N).

The tie-down devices shall be an embedded strap type, installed in accordance with the manufacturer's recommendations. The panels shall be supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom.

Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned down slab

edge is permitted at door openings in the braced wall line. This continuous footing or turned down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped not less than 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

2. In the first story of two-story buildings, each wall panel shall be braced in accordance with Item 1 above, except that each panel shall have a length of not less than 24 inches (610 mm).

**2308.9.4 Cripple walls.** Foundation cripple walls shall be framed of studs not less in size than the studding above with a minimum length of 14 inches (356 mm), or shall be framed of solid blocking. Where exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story.

**2308.9.4.1 Bracing.** For the purposes of this section, cripple walls having a stud height exceeding 14 inches (356 mm) in structures assigned to Seismic Design Category A, B or C shall be considered a story and shall be braced in accordance with Table 2308.9.3(1). See Section 2308.12.4 for cripple walls in structures assigned to Seismic Design Category D or E.

**2308.9.4.2 Nailing of bracing.** Spacing of edge nailing for required wall bracing shall not exceed 6 inches (152 mm) o.c. along the foundation plate and the top plate of the cripple wall. Nail size, nail spacing for field nailing and more restrictive boundary nailing requirements shall be as required elsewhere in the code for the specific bracing material used.

**2308.9.5 Openings in exterior walls.** Openings in exterior walls shall be constructed in accordance with Sections 2308.9.5.1 and 2308.9.5.2.

**2308.9.5.1 Headers.** Headers shall be provided over each opening in exterior-bearing walls. The spans in Table 2308.9.5 are permitted to be used for one- and two-family dwellings. Headers for other buildings shall be designed in accordance with Section 2301.2, Item 1 or 2. Headers shall be of two pieces of nominal 2-inch (51 mm) framing lumber set on edge as permitted by Table 2308.9.5 and nailed together in accordance with Table 2304.9.1 or of solid lumber of equivalent size.

**2308.9.5.2 Header support.** Wall studs shall support the ends of the header in accordance with Table 2308.9.5. Each end of a lintel or header shall have a length of bearing of not less than  $1\frac{1}{2}$  inches (38 mm) for the full width of the lintel.

**2308.9.6 Openings in interior bearing partitions.** Headers shall be provided over each opening in interior bearing partitions as required in Section 2308.9.5. The spans in Table 2308.9.6 are permitted to be used. Wall studs shall support the ends of the header in accordance with Table 2308.9.5 or 2308.9.6, as appropriate.

**TABLE 2308.9.3(1)  
BRACED WALL PANELS<sup>a</sup>**

SEISMIC DESIGN CATEGORY	CONDITION	CONSTRUCTION METHODS <sup>b, c</sup>								BRACED PANEL LOCATION AND LENGTH <sup>d</sup>
		1	2	3	4	5	6	7	8	
A and B	One story, top of two or three story	X	X	X	X	X	X	X	X	Located in accordance with Section 2308.9.3 and not more than 25 feet on center.
	First story of two story or second story of three story	X	X	X	X	X	X	X	X	
	First story of three story	—	X	X	X	X <sup>e</sup>	X	X	X	
C	One story or top of two story	—	X	X	X	X	X	X	X	Located in accordance with Section 2308.9.3 and not more than 25 feet on center.
	First story of two story	—	X	X	X	X <sup>e</sup>	X	X	X	Located in accordance with Section 2308.9.3 and not more than 25 feet on center, but total length shall not be less than 25% of building length <sup>f</sup> .

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. This table specifies minimum requirements for braced panels that form interior or exterior braced wall lines.

b. See Section 2308.9.3 for full description.

c. See Sections 2308.9.3.1 and 2308.9.3.2 for alternative braced panel requirements.

d. Building length is the dimension parallel to the braced wall length.

e. Gypsum wallboard applied to framing supports that are spaced at 16 inches on center.

f. The required lengths shall be doubled for gypsum board applied to only one face of a braced wall panel.

**TABLE 2308.9.3(2)  
EXPOSED PLYWOOD PANEL SIDING**

MINIMUM THICKNESS <sup>a</sup> (inch)	MINIMUM NUMBER OF PLYS	STUD SPACING (inches)
		Plywood siding applied directly to studs or over sheathing
$\frac{3}{8}$	3	16 <sup>b</sup>
$\frac{1}{2}$	4	24

For SI: 1 inch = 25.4 mm.

a. Thickness of grooved panels is measured at bottom of grooves.

b. Spans are permitted to be 24 inches if plywood siding applied with face grain perpendicular to studs or over one of the following: (1) 1-inch board sheathing, (2)  $\frac{7}{16}$ -inch wood structural panel sheathing or (3)  $\frac{3}{8}$ -inch wood structural panel sheathing with strength axis (which is the long direction of the panel unless otherwise marked) of sheathing perpendicular to studs.

**TABLE 2308.9.3(3)  
WOOD STRUCTURAL PANEL WALL SHEATHING<sup>b</sup>  
(Not Exposed to the Weather, Strength Axis Parallel or Perpendicular to Studs Except as Indicated Below)**

MINIMUM THICKNESS (inch)	PANEL SPAN RATING	STUD SPACING (inches)		
		Siding nailed to studs	Nailable sheathing	
			Sheathing parallel to studs	Sheathing perpendicular to studs
$\frac{3}{8}$ , $\frac{15}{32}$ , $\frac{1}{2}$	16/0, 20/0, 24/0, 32/16 Wall—24" o.c.	24	16	24
$\frac{7}{16}$ , $\frac{15}{32}$ , $\frac{1}{2}$	24/0, 24/16, 32/16 Wall—24" o.c.	24	24 <sup>a</sup>	24

For SI: 1 inch = 25.4 mm.

a. Plywood shall consist of four or more plies.

b. Blocking of horizontal joints shall not be required except as specified in Sections 2306.3 and 2308.12.4.

**TABLE 2308.9.3(4)**  
**ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING**  
**(Not Exposed to the Weather, Long Dimension of the Panel Parallel or Perpendicular to Studs)**

GRADE	THICKNESS (inch)	STUD SPACING (inches)	
		Siding nailed to studs	Sheathing under coverings specified in Section 2308.9.3 parallel or perpendicular to studs
M-S "Exterior Glue" and M-2 "Exterior Glue"	$\frac{3}{8}$	16	—
	$\frac{1}{2}$	16	16

For SI: 1 inch = 25.4 mm.

**TABLE 2308.9.3(5)**  
**HARDBOARD SIDING**

SIDING	MINIMUM NOMINAL THICKNESS (inch)	2 x 4 FRAMING MAXIMUM SPACING	NAIL SIZE <sup>a, b, d</sup>	NAIL SPACING	
				General	Bracing panels <sup>c</sup>
1. Lap siding					
Direct to studs	<sup>3</sup> / <sub>8</sub>	16" o.c.	8d	16" o.c.	Not applicable
Over sheathing	<sup>3</sup> / <sub>8</sub>	16" o.c.	10d	16" o.c.	Not applicable
2. Square edge panel siding					
Direct to studs	<sup>3</sup> / <sub>8</sub>	24" o.c.	6d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
Over sheathing	<sup>3</sup> / <sub>8</sub>	24" o.c.	8d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
3. Shiplap edge panel siding					
Direct to studs	<sup>3</sup> / <sub>8</sub>	16" o.c.	6d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
Over sheathing	<sup>3</sup> / <sub>8</sub>	16" o.c.	8d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

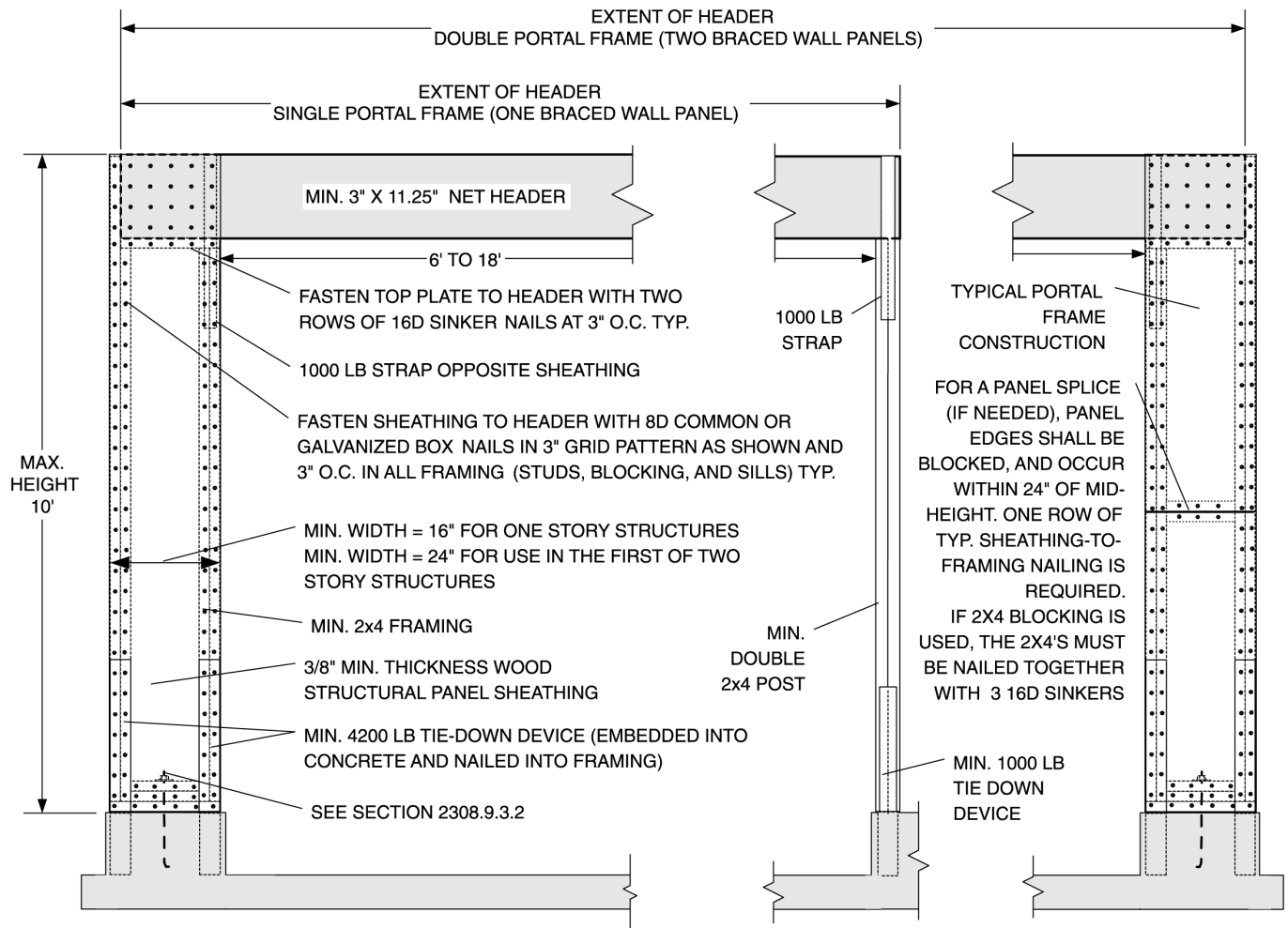
a. Nails shall be corrosion resistant.

b. Minimum acceptable nail dimensions:

c. Where used to comply with Section 2308.9.3.

	Panel Siding (inch)	Lap Siding (inch)
Shank diameter	0.092	0.099
Head diameter	0.225	0.240

d. Nail length must accommodate the sheathing and penetrate framing  $1\frac{1}{2}$  inches.



For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound = 4.448 N.

**FIGURE 2308.9.3.2**  
**ALTERNATE BRACED WALL PANEL ADJACENT TO A DOOR OR WINDOW OPENING**



**TABLE 2308.9.5**  
**HEADER AND GIRDER SPANS<sup>a</sup> FOR EXTERIOR BEARING WALLS**  
 (Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir<sup>b</sup> and Required Number of Jack Studs)

HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) <sup>c</sup>											
		30						50					
		Building width <sup>c</sup> (feet)											
		20		28		36		20		28		36	
		Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>
Roof & Ceiling	2-2×4	3-6	1	3-2	1	2-10	1	3-2	1	2-9	1	2-6	1
	2-2×6	5-5	1	4-8	1	4-2	1	4-8	1	4-1	1	3-8	2
	2-2×8	6-10	1	5-11	2	5-4	2	5-11	2	5-2	2	4-7	2
	2-2×10	8-5	2	7-3	2	6-6	2	7-3	2	6-3	2	5-7	2
	2-2×12	9-9	2	8-5	2	7-6	2	8-5	2	7-3	2	6-6	2
	3-2×8	8-4	1	7-5	1	6-8	1	7-5	1	6-5	2	5-9	2
	3-2×10	10-6	1	9-1	2	8-2	2	9-1	2	7-10	2	7-0	2
	3-2×12	12-2	2	10-7	2	9-5	2	10-7	2	9-2	2	8-2	2
	4-2×8	9-2	1	8-4	1	7-8	1	8-4	1	7-5	1	6-8	1
	4-2×10	11-8	1	10-6	1	9-5	2	10-6	1	9-1	2	8-2	2
4-2×12	14-1	1	12-2	2	10-11	2	12-2	2	10-7	2	9-5	2	
Roof, Ceiling & 1 Center-Bearing Floor	2-2×4	3-1	1	2-9	1	2-5	1	2-9	1	2-5	1	2-2	1
	2-2×6	4-6	1	4-0	1	3-7	2	4-1	1	3-7	2	3-3	2
	2-2×8	5-9	2	5-0	2	4-6	2	5-2	2	4-6	2	4-1	2
	2-2×10	7-0	2	6-2	2	5-6	2	6-4	2	5-6	2	5-0	2
	2-2×12	8-1	2	7-1	2	6-5	2	7-4	2	6-5	2	5-9	3
	3-2×8	7-2	1	6-3	2	5-8	2	6-5	2	5-8	2	5-1	2
	3-2×10	8-9	2	7-8	2	6-11	2	7-11	2	6-11	2	6-3	2
	3-2×12	10-2	2	8-11	2	8-0	2	9-2	2	8-0	2	7-3	2
	4-2×8	8-1	1	7-3	1	6-7	1	7-5	1	6-6	1	5-11	2
	4-2×10	10-1	1	8-10	2	8-0	2	9-1	2	8-0	2	7-2	2
4-2×12	11-9	2	10-3	2	9-3	2	10-7	2	9-3	2	8-4	2	
Roof, Ceiling & 1 Clear Span Floor	2-2×4	2-8	1	2-4	1	2-1	1	2-7	1	2-3	1	2-0	1
	2-2×6	3-11	1	3-5	2	3-0	2	3-10	2	3-4	2	3-0	2
	2-2×8	5-0	2	4-4	2	3-10	2	4-10	2	4-2	2	3-9	2
	2-2×10	6-1	2	5-3	2	4-8	2	5-11	2	5-1	2	4-7	3
	2-2×12	7-1	2	6-1	3	5-5	3	6-10	2	5-11	3	5-4	3
	3-2×8	6-3	2	5-5	2	4-10	2	6-1	2	5-3	2	4-8	2
	3-2×10	7-7	2	6-7	2	5-11	2	7-5	2	6-5	2	5-9	2
	3-2×12	8-10	2	7-8	2	6-10	2	8-7	2	7-5	2	6-8	2
	4-2×8	7-2	1	6-3	2	5-7	2	7-0	1	6-1	2	5-5	2
	4-2×10	8-9	2	7-7	2	6-10	2	8-7	2	7-5	2	6-7	2
4-2×12	10-2	2	8-10	2	7-11	2	9-11	2	8-7	2	7-8	2	

(continued)

**TABLE 2308.9.5—continued**  
**HEADER AND GIRDER SPANS<sup>a</sup> FOR EXTERIOR BEARING WALLS**  
**(Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir<sup>b</sup> and Required Number of Jack Studs)**

HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf)*											
		30						50					
		Building width <sup>c</sup> (feet)											
		20		28		36		20		28		36	
		Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>
Roof, Ceiling & 2 Center-Bearing Floors	2-2×4	2-7	1	2-3	1	2-0	1	2-6	1	2-2	1	1-11	1
	2-2×6	3-9	2	3-3	2	2-11	2	3-8	2	3-2	2	2-10	2
	2-2×8	4-9	2	4-2	2	3-9	2	4-7	2	4-0	2	3-8	2
	2-2×10	5-9	2	5-1	2	4-7	3	5-8	2	4-11	2	4-5	3
	2-2×12	6-8	2	5-10	3	5-3	3	6-6	2	5-9	3	5-2	3
	3-2×8	5-11	2	5-2	2	4-8	2	5-9	2	5-1	2	4-7	2
	3-2×10	7-3	2	6-4	2	5-8	2	7-1	2	6-2	2	5-7	2
	3-2×12	8-5	2	7-4	2	6-7	2	8-2	2	7-2	2	6-5	3
	4-2×8	6-10	1	6-0	2	5-5	2	6-8	1	5-10	2	5-3	2
	4-2×10	8-4	2	7-4	2	6-7	2	8-2	2	7-2	2	6-5	2
	4-2×12	9-8	2	8-6	2	7-8	2	9-5	2	8-3	2	7-5	2
Roof, Ceiling & 2 Clear Span Floors	2-2×4	2-1	1	1-8	1	1-6	2	2-0	1	1-8	1	1-5	2
	2-2×6	3-1	2	2-8	2	2-4	2	3-0	2	2-7	2	2-3	2
	2-2×8	3-10	2	3-4	2	3-0	3	3-10	2	3-4	2	2-11	3
	2-2×10	4-9	2	4-1	3	3-8	3	4-8	2	4-0	3	3-7	3
	2-2×12	5-6	3	4-9	3	4-3	3	5-5	3	4-8	3	4-2	3
	3-2×8	4-10	2	4-2	2	3-9	2	4-9	2	4-1	2	3-8	2
	3-2×10	5-11	2	5-1	2	4-7	3	5-10	2	5-0	2	4-6	3
	3-2×12	6-10	2	5-11	3	5-4	3	6-9	2	5-10	3	5-3	3
	4-2×8	5-7	2	4-10	2	4-4	2	5-6	2	4-9	2	4-3	2
	4-2×10	6-10	2	5-11	2	5-3	2	6-9	2	5-10	2	5-2	2
	4-2×12	7-11	2	6-10	2	6-2	3	7-9	2	6-9	2	6-0	3

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m<sup>2</sup>.

a. Spans are given in feet and inches (ft-in).

b. Tabulated values are for No. 2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Use 30 pounds per square foot ground snow load for cases in which ground snow load is less than 30 pounds per square foot and the roof live load is equal to or less than 20 pounds per square foot.

**TABLE 2308.9.6**  
**HEADER AND GIRDER SPANS<sup>a</sup> FOR INTERIOR BEARING WALLS**  
 (Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir<sup>b</sup> and Required Number of Jack Studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING width <sup>c</sup> (feet)					
		20		28		36	
		Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>	Span	NJ <sup>d</sup>
One Floor Only	2-2×4	3-1	1	2-8	1	2-5	1
	2-2×6	4-6	1	3-11	1	3-6	1
	2-2×8	5-9	1	5-0	2	4-5	2
	2-2×10	7-0	2	6-1	2	5-5	2
	2-2×12	8-1	2	7-0	2	6-3	2
	3-2×8	7-2	1	6-3	1	5-7	2
	3-2×10	8-9	1	7-7	2	6-9	2
	3-2×12	10-2	2	8-10	2	7-10	2
	4-2×8	9-0	1	7-8	1	6-9	1
	4-2×10	10-1	1	8-9	1	7-10	2
	4-2×12	11-9	1	10-2	2	9-1	2
Two Floors	2-2×4	2-2	1	1-10	1	1-7	1
	2-2×6	3-2	2	2-9	2	2-5	2
	2-2×8	4-1	2	3-6	2	3-2	2
	2-2×10	4-11	2	4-3	2	3-10	3
	2-2×12	5-9	2	5-0	3	4-5	3
	3-2×8	5-1	2	4-5	2	3-11	2
	3-2×10	6-2	2	5-4	2	4-10	2
	3-2×12	7-2	2	6-3	2	5-7	3
	4-2×8	6-1	1	5-3	2	4-8	2
	4-2×10	7-2	2	6-2	2	5-6	2
	4-2×12	8-4	2	7-2	2	6-5	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches (ft-in).

b. Tabulated values are for No. 2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the headers are permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

### 2308.9.7 Openings in interior nonbearing partitions.

Openings in nonbearing partitions are permitted to be framed with single studs and headers. Each end of a lintel or header shall have a length of bearing of not less than 1½ inches (38 mm) for the full width of the lintel.

**2308.9.8 Pipes in walls.** Stud partitions containing plumbing, heating or other pipes shall be so framed and the joists underneath so spaced as to give proper clearance for the piping. Where a partition containing such piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of such pipes and shall be bridged. Where plumbing, heating or other pipes are placed in or partly in a partition, necessitating the cutting of the soles or plates, a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and 1½ inches (38 mm) wide shall be fastened to each plate across and to each side of the opening with not less than six 16d nails.

**2308.9.9 Bridging.** Unless covered by interior or exterior wall coverings or sheathing meeting the minimum requirements of this code, stud partitions or walls with studs having a height-to-least-thickness ratio exceeding 50 shall have bridging not less than 2 inches (51 mm) in thickness and of the same width as the studs fitted snugly and nailed thereto to provide adequate lateral support. Bridging shall be placed in every stud cavity and at a frequency such that no stud so braced shall have a height-to-least-thickness ratio exceeding 50 with the height of the stud measured between horizontal framing and bridging or between bridging, whichever is greater.

**2308.9.10 Cutting and notching.** In exterior walls and bearing partitions, any wood stud is permitted to be cut or notched to a depth not exceeding 25 percent of its width. Cutting or notching of studs to a depth not greater than 40 percent of the width of the stud is permitted in nonbearing partitions supporting no loads other than the weight of the partition.

**TABLE 2308.10.1**  
**REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)<sup>a, b, c, e, f, g, h</sup>**

NOMINAL DESIGN WIND SPEED, $V_{asd}$ <sup>i</sup>	ROOF SPAN (feet)							OVERHANGS (pounds/feet) <sup>d</sup>
	12	20	24	28	32	36	40	
85	-72	-120	-145	-169	-193	-217	-241	-38.55
90	-91	-151	-181	-212	-242	-272	-302	-43.22
100	-131	-281	-262	-305	-349	-393	-436	-53.36
110	-175	-292	-351	-409	-467	-526	-584	-64.56

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 30-foot mean roof height located in Exposure B. For Exposure C or D and for other mean roof heights, multiply the above loads by the adjustment coefficients below.

EXPOSURE	Mean Roof Height (feet)									
	15	20	25	30	35	40	45	50	55	60
B	1.00	1.00	1.00	1.00	1.05	1.09	1.12	1.16	1.19	1.22
C	1.21	1.29	1.35	1.40	1.45	1.49	1.53	1.56	1.59	1.62
D	1.47	1.55	1.61	1.66	1.70	1.74	1.78	1.81	1.84	1.87

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for 10 pounds of dead load.

d. The uplift connection requirements do not account for the effects of overhangs. The magnitude of the above loads shall be increased by adding the overhang loads found in the table. The overhang loads are also based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.

e. The uplift connection requirements are based upon wind loading on end zones as defined in Figure 28.6.3 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of  $V_{asd}$  and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications.

i.  $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

**2308.9.11 Bored holes.** A hole not greater in diameter than 40 percent of the stud width is permitted to be bored in any wood stud. Bored holes not greater than 60 percent of the width of the stud are permitted in nonbearing partitions or in any wall where each bored stud is doubled, provided not more than two such successive doubled studs are so bored.

In no case shall the edge of the bored hole be nearer than  $\frac{5}{8}$  inch (15.9 mm) to the edge of the stud.

Bored holes shall not be located at the same section of stud as a cut or notch.

**2308.10 Roof and ceiling framing.** The framing details required in this section apply to roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) or greater. Where the roof slope is less than three units vertical in 12 units horizontal (25-percent slope), members supporting rafters and ceiling joists such as ridge board, hips and valleys shall be designed as beams.

**2308.10.1 Wind uplift.** The roof construction shall have rafter and truss ties to the wall below. Resultant uplift

loads shall be transferred to the foundation using a continuous load path. The rafter or truss to wall connection shall comply with Tables 2304.9.1 and 2308.10.1.

**2308.10.2 Ceiling joist spans.** Allowable spans for ceiling joists shall be in accordance with Table 2308.10.2(1) or 2308.10.2(2). For other grades and species, refer to the *AF&PA Span Tables for Joists and Rafters*.

**2308.10.3 Rafter spans.** Allowable spans for rafters shall be in accordance with Table 2308.10.3(1), 2308.10.3(2), 2308.10.3(3), 2308.10.3(4), 2308.10.3(5) or 2308.10.3(6). For other grades and species, refer to the *AF&PA Span Tables for Joists and Rafters*.

**2308.10.4 Ceiling joist and rafter framing.** Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board at least 1-inch (25 mm) nominal thickness at ridges and not less in depth than the cut end of the rafter. At valleys and hips, there shall be a single valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter.

**TABLE 2308.10.2(1)**  
**CEILING JOIST SPANS FOR COMMON LUMBER SPECIES**  
(Uninhabitable Attics Without Storage, Live Load = 10 pounds psf,  $L/\Delta = 240$ )

CEILING JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 5 pounds per square foot			
		2 x 4	2 x 6	2 x 8	2 x 10
		Maximum ceiling joist spans			
		(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch SS	13-2	20-8	26-0	26-0
	Douglas Fir-Larch #1	12-8	19-11	26-0	26-0
	Douglas Fir-Larch #2	12-5	19-6	25-8	26-0
	Douglas Fir-Larch #3	10-10	15-10	20-1	24-6
	Hem-Fir SS	12-5	19-6	25-8	26-0
	Hem-Fir #1	12-2	19-1	25-2	26-0
	Hem-Fir #2	11-7	18-2	24-0	26-0
	Hem-Fir #3	10-10	15-10	20-1	24-6
	Southern Pine SS	12-11	20-3	26-0	26-0
	Southern Pine #1	12-8	19-11	26-0	26-0
	Southern Pine #2	12-5	19-6	25-8	26-0
	Southern Pine #3	11-6	17-0	21-8	25-7
	Spruce-Pine-Fir SS	12-2	19-1	25-2	26-0
	Spruce-Pine-Fir #1	11-10	18-8	24-7	26-0
	Spruce-Pine-Fir #2	11-10	18-8	24-7	26-0
	Spruce-Pine-Fir #3	10-10	15-10	20-1	24-6
16	Douglas Fir-Larch SS	11-11	18-9	24-8	26-0
	Douglas Fir-Larch #1	11-6	18-1	23-10	26-0
	Douglas Fir-Larch #2	11-3	17-8	23-0	26-0
	Douglas Fir-Larch #3	9-5	13-9	17-5	21-3
	Hem-Fir SS	11-3	17-8	23-4	26-0
	Hem-Fir #1	11-0	17-4	22-10	26-0
	Hem-Fir #2	10-6	16-6	21-9	26-0
	Hem-Fir #3	9-5	13-9	17-5	21-3
	Southern Pine SS	11-9	18-5	24-3	26-0
	Southern Pine #1	11-6	18-1	23-1	26-0
	Southern Pine #2	11-3	17-8	23-4	26-0
	Southern Pine #3	10-0	14-9	18-9	22-2
	Spruce-Pine-Fir SS	11-0	17-4	22-10	26-0
	Spruce-Pine-Fir #1	10-9	16-11	22-4	26-0
	Spruce-Pine-Fir #2	10-9	16-11	22-4	26-0
	Spruce-Pine-Fir #3	9-5	13-9	17-5	21-3

(continued)

**TABLE 2308.10.2(1)—continued**  
**CEILING JOIST SPANS FOR COMMON LUMBER SPECIES**  
(Uninhabitable Attics Without Storage, Live Load = 10 pounds psf,  $L/\Delta = 240$ )

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 pounds per square foot			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	11-3	17-8	23-3	26-0
	Douglas Fir-Larch	#1	10-10	17-0	22-5	26-0
	Douglas Fir-Larch	#2	10-7	16-7	21-0	25-8
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5
	Hem-Fir	SS	10-7	16-8	21-11	26-0
	Hem-Fir	#1	10-4	16-4	21-6	26-0
	Hem-Fir	#2	9-11	15-7	20-6	25-3
	Hem-Fir	#3	8-7	12-6	15-10	19-5
	Southern Pine	SS	11-0	17-4	22-10	26-0
	Southern Pine	#1	10-10	17-0	22-5	26-0
	Southern Pine	#2	10-7	16-8	21-11	26-0
	Southern Pine	#3	9-1	13-6	17-2	20-3
	Spruce-Pine-Fir	SS	10-4	16-4	21-6	26-0
	Spruce-Pine-Fir	#1	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#2	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5
24	Douglas Fir-Larch	SS	10-5	16-4	21-7	26-0
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	26-0
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	26-0
	Southern Pine	#1	10-0	15-9	20-10	26-0
	Southern Pine	#2	9-10	15-6	20-1	23-11
	Southern Pine	#3	8-2	12-0	15-4	18-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m<sup>2</sup>.

**TABLE 2308.10.2(2)**  
**CEILING JOIST SPANS FOR COMMON LUMBER SPECIES**  
(Uninhabitable Attics With Limited Storage, Live Load = 20 pounds per square foot,  $L/\Delta = 240$ )

CEILING JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 pounds per square foot				
		2 × 4	2 × 6	2 × 8	2 × 10	
		Maximum ceiling joist spans				
		(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	26-0
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	26-0
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	26-0
	Southern Pine	#1	10-0	15-9	20-10	26-0
	Southern Pine	#2	9-10	15-6	20-1	23-11
	Southern Pine	#3	8-2	12-0	15-4	18-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0
	Douglas Fir-Larch	#1	9-1	13-9	17-5	21-3
	Douglas Fir-Larch	#2	8-9	12-10	16-3	19-10
	Douglas Fir-Larch	#3	6-8	9-8	12-4	15-0
	Hem-Fir	SS	8-11	14-1	18-6	23-8
	Hem-Fir	#1	8-9	13-5	16-10	20-8
	Hem-Fir	#2	8-4	12-8	16-0	19-7
	Hem-Fir	#3	6-8	9-8	12-4	15-0
	Southern Pine	SS	9-4	14-7	19-3	24-7
	Southern Pine	#1	9-1	14-4	18-11	23-1
	Southern Pine	#2	8-11	13-6	17-5	20-9
	Southern Pine	#3	7-1	10-5	13-3	15-8
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1
	Spruce-Pine-Fir	#1	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#2	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#3	6-8	9-8	12-4	15-0

(continued)

**TABLE 2308.10.2(2)—continued**  
**CEILING JOIST SPANS FOR COMMON LUMBER SPECIES**  
(Uninhabitable Attics With Limited Storage, Live Load = 20 pounds per square foot,  $L/\Delta = 240$ )

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-4
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8
	Hem-Fir	SS	8-5	13-3	17-5	22-3
	Hem-Fir	#1	8-3	12-3	15-6	18-11
	Hem-Fir	#2	7-10	11-7	14-8	17-10
	Hem-Fir	#3	6-1	8-10	11-3	13-8
	Southern Pine	SS	8-9	13-9	18-1	23-1
	Southern Pine	#1	8-7	13-6	17-9	21-1
	Southern Pine	#2	8-5	12-3	15-10	18-11
	Southern Pine	#3	6-5	9-6	12-1	14-4
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-8
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8
24	Douglas Fir-Larch	SS	8-3	13-0	17-1	20-11
	Douglas Fir-Larch	#1	7-8	11-2	14-2	17-4
	Douglas Fir-Larch	#2	7-2	10-6	13-3	16-3
	Douglas Fir-Larch	#3	5-5	7-11	10-0	12-3
	Hem-Fir	SS	7-10	12-3	16-2	20-6
	Hem-Fir	#1	7-6	10-11	13-10	16-11
	Hem-Fir	#2	7-1	10-4	13-1	16-0
	Hem-Fir	#3	5-5	7-11	10-0	12-3
	Southern Pine	SS	8-1	12-9	16-10	21-6
	Southern Pine	#1	8-0	12-6	15-10	18-10
	Southern Pine	#2	7-8	11-0	14-2	16-11
	Southern Pine	#3	5-9	8-6	10-10	12-10
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	19-5
	Spruce-Pine-Fir	#1	7-2	10-6	13-3	16-3
	Spruce-Pine-Fir	#2	7-2	10-6	13-3	16-3
	Spruce-Pine-Fir	#3	5-5	7-11	10-0	12-3

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m<sup>2</sup>.





**TABLE 2308.10.3(1)**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
 (Roof Live Load = 20 pounds per square foot, Ceiling Not Attached to Rafters,  $L/\Delta = 180$ )

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-6	18-0	23-9	26-0	26-0	11-6	18-0	23-5	26-0	26-0
	Douglas Fir-Larch	#1	11-1	17-4	22-5	26-0	26-0	10-6	15-4	19-5	23-9	26-0
	Douglas Fir-Larch	#2	10-10	16-7	21-0	25-8	26-0	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	10-10	17-0	22-5	26-0	26-0	10-10	17-0	22-5	26-0	26-0
	Hem-Fir	#1	10-7	16-8	21-10	26-0	26-0	10-3	14-11	18-11	23-2	26-0
	Hem-Fir	#2	10-1	15-11	20-8	25-3	26-0	9-8	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	11-3	17-8	23-4	26-0	26-0	11-3	17-8	23-4	26-0	26-0
	Southern Pine	#1	11-1	17-4	22-11	26-0	26-0	11-1	17-3	21-9	25-10	26-0
	Southern Pine	#2	10-10	17-0	22-5	26-0	26-0	10-6	15-1	19-5	23-2	26-0
	Southern Pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-Pine-Fir	SS	10-7	16-8	21-11	26-0	26-0	10-7	16-8	21-9	26-0	26-0
	Spruce-Pine-Fir	#1	10-4	16-3	21-0	25-8	26-0	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	10-4	16-3	21-0	25-8	26-0	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	10-5	16-4	21-7	26-0	26-0	10-5	16-0	20-3	24-9	26-0
	Douglas Fir-Larch	#1	10-0	15-4	19-5	23-9	26-0	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	9-10	15-6	20-5	26-0	26-0	9-10	15-6	19-11	24-4	26-0
	Hem-Fir	#1	9-8	14-11	18-11	23-2	26-0	8-10	12-11	16-5	20-0	23-3
	Hem-Fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	10-3	16-1	21-2	26-0	26-0	10-3	16-1	21-2	26-0	26-0
	Southern Pine	#1	10-0	15-9	20-10	25-10	26-0	10-0	15-0	18-10	22-4	26-0
	Southern Pine	#2	9-10	15-1	19-5	23-2	26-0	9-1	13-0	16-10	20-1	23-7
	Southern Pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	26-0	9-8	14-10	18-10	23-0	26-0
	Spruce-Pine-Fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

**TABLE 2308.10.3(1)—continued**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
**(Roof Live Load = 20 pounds per square foot, Ceiling Not Attached to Rafters,  $L/\Delta = 180$ )**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	9-10	15-5	20-4	25-11	26-0	9-10	14-7	18-6	22-7	26-0
	Douglas Fir-Larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	9-3	14-7	19-2	24-6	26-0	9-3	14-4	18-2	22-3	25-9
	Hem-Fir	#1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	9-8	15-2	19-11	25-5	26-0	9-8	15-2	19-11	25-5	26-0
	Southern Pine	#1	9-5	14-10	19-7	23-7	26-0	9-3	13-8	17-2	20-5	24-4
	Southern Pine	#2	9-3	13-9	17-9	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern Pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-Pine-Fir	SS	9-1	14-3	18-9	23-11	26-0	9-1	13-7	17-2	21-0	24-4
	Spruce-Pine-Fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-4	26-0	8-11	13-1	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	8-7	13-6	17-10	22-9	26-0	8-7	12-10	16-3	19-10	23-0
	Hem-Fir	#1	8-4	12-3	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-11	14-1	18-6	23-8	26-0	8-11	14-1	18-6	22-11	26-0
	Southern Pine	#1	8-9	13-9	17-9	21-1	25-2	8-3	12-3	15-4	18-3	21-9
	Southern Pine	#2	8-7	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern Pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m<sup>2</sup>.

**TABLE 2308.10.3(2)**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
(Roof Live Load = 20 pounds per square foot, Ceiling Attached to Rafters,  $L/\Delta = 240$ )

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	26-0	26-0	10-5	16-4	21-7	26-0	26-0
	Douglas Fir-Larch	#1	10-0	15-9	20-10	26-0	26-0	10-0	15-4	19-5	23-9	26-0
	Douglas Fir-Larch	#2	9-10	15-6	20-5	25-8	26-0	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	9-10	15-6	20-5	26-0	26-0	9-10	15-6	20-5	26-0	26-0
	Hem-Fir	#1	9-8	15-2	19-11	25-5	26-0	9-8	14-11	18-11	23-2	26-0
	Hem-Fir	#2	9-2	14-5	19-0	24-3	26-0	9-2	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	10-3	16-1	21-2	26-0	26-0	10-3	16-1	21-2	26-0	26-0
	Southern Pine	#1	10-0	15-9	20-10	26-0	26-0	10-0	15-9	20-10	25-10	26-0
	Southern Pine	#2	9-10	15-6	20-5	26-0	26-0	9-10	15-1	19-5	23-2	26-0
	Southern Pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	26-0	9-8	15-2	19-11	25-5	26-0
	Spruce-Pine-Fir	#1	9-5	14-9	19-6	24-10	26-0	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	9-5	14-9	19-6	24-10	26-0	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0	26-0	9-6	14-11	19-7	24-9	26-0
	Douglas Fir-Larch	#1	9-1	14-4	18-11	23-9	26-0	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	8-11	14-1	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	8-11	14-1	18-6	23-8	26-0	8-11	14-1	18-6	23-8	26-0
	Hem-Fir	#1	8-9	13-9	18-1	23-1	26-0	8-9	12-11	16-5	20-0	23-3
	Hem-Fir	#2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	9-4	14-7	19-3	24-7	26-0	9-4	14-7	19-3	24-7	26-0
	Southern Pine	#1	9-1	14-4	18-11	24-1	26-0	9-1	14-4	18-10	22-4	26-0
	Southern Pine	#2	8-11	14-1	18-6	23-2	26-0	8-11	13-0	16-10	20-1	23-7
	Southern Pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1	26-0	8-9	13-9	18-1	23-0	26-0
	Spruce-Pine-Fir	#1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

**TABLE 2308.10.3(2)—continued**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
**(Roof Live Load = 20 pounds per square foot, Ceiling Attached to Rafters,  $L/\Delta = 240$ )**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-7	26-0	8-11	14-0	18-5	22-7	26-0
	Douglas Fir-Larch	#1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-5	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	8-5	13-3	17-5	22-3	26-0	8-5	13-3	17-5	22-3	25-9
	Hem-Fir	#1	8-3	12-11	17-1	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	8-9	13-9	18-1	23-1	26-0	8-9	13-9	18-1	23-1	26-0
	Southern Pine	#1	8-7	13-6	17-9	22-8	26-0	8-7	13-6	17-2	20-5	24-4
	Southern Pine	#2	8-5	13-3	17-5	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern Pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-9	26-0	8-3	12-11	17-1	21-0	24-4
	Spruce-Pine-Fir	#1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	26-0	8-3	13-0	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	7-10	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0
	Hem-Fir	#1	7-8	12-0	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-1	12-9	16-10	21-6	26-0	8-1	12-9	16-10	21-6	26-0
	Southern Pine	#1	8-0	12-6	16-6	21-1	25-2	8-0	12-3	15-4	18-3	21-9
	Southern Pine	#2	7-10	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern Pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m<sup>2</sup>.

**TABLE 2308.10.3(3)**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
 (Ground Snow Load = 30 pounds per square foot, Ceiling Not Attached to Rafters,  $L/\Delta = 180$ )

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-0	15-9	20-9	26-0	26-0	10-0	15-9	20-1	24-6	26-0
	Douglas Fir-Larch	#1	9-8	14-9	18-8	22-9	26-0	9-0	13-2	16-8	20-4	23-7
	Douglas Fir-Larch	#2	9-5	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas Fir-Larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	SS	9-6	14-10	19-7	25-0	26-0	9-6	14-10	19-7	24-1	26-0
	Hem-Fir	#1	9-3	14-4	18-2	22-2	25-9	8-9	12-10	16-3	19-10	23-0
	Hem-Fir	#2	8-10	13-7	17-2	21-0	24-4	8-4	12-2	15-4	18-9	21-9
	Hem-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern Pine	SS	9-10	15-6	20-5	26-0	26-0	9-10	15-6	20-5	26-0	26-0
	Southern Pine	#1	9-8	15-2	20-0	24-9	26-0	9-8	14-10	18-8	22-2	26-0
	Southern Pine	#2	9-6	14-5	18-8	22-3	26-0	9-0	12-11	16-8	19-11	23-4
	Southern Pine	#3	7-7	11-2	14-3	16-10	20-0	6-9	10-0	12-9	15-1	17-11
	Spruce-Pine-Fir	SS	9-3	14-7	19-2	24-6	26-0	9-3	14-7	18-8	22-9	26-0
	Spruce-Pine-Fir	#1	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#2	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-9	26-0	9-1	13-9	17-5	21-3	24-8
	Douglas Fir-Larch	#1	8-9	12-9	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas Fir-Larch	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas Fir-Larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-Fir	SS	8-7	13-6	17-10	22-9	26-0	8-7	13-6	17-1	20-10	24-2
	Hem-Fir	#1	8-5	12-5	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-Fir	#2	8-0	11-9	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern Pine	SS	8-11	14-1	18-6	23-8	26-0	8-11	14-1	18-6	23-8	26-0
	Southern Pine	#1	8-9	13-9	18-1	21-5	25-7	8-8	12-10	16-2	19-2	22-10
	Southern Pine	#2	8-7	12-6	16-2	19-3	22-7	7-10	11-2	14-5	17-3	20-2
	Southern Pine	#3	6-7	9-8	12-4	14-7	17-4	5-10	8-8	11-0	13-0	15-6
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	22-1	25-7	8-5	12-9	16-2	19-9	22-10
	Spruce-Pine-Fir	#1	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6

(continued)

**TABLE 2308.10.3(3)—continued**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
**(Ground Snow Load = 30 pounds per square foot, Ceiling Not Attached to Rafters,  $L/\Delta = 180$ )**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-7	13-6	17-9	21-8	25-2	8-7	12-6	15-10	19-5	22-6
	Douglas Fir-Larch	#1	7-11	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas Fir-Larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-Fir	SS	8-1	12-9	16-9	21-4	24-8	8-1	12-4	15-7	19-1	22-1
	Hem-Fir	#1	7-9	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-Fir	#2	7-4	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern Pine	SS	8-5	13-3	17-5	22-3	26-0	8-5	13-3	17-5	22-0	25-9
	Southern Pine	#1	8-3	13-0	16-6	19-7	23-4	7-11	11-9	14-9	17-6	20-11
	Southern Pine	#2	7-11	11-5	14-9	17-7	20-7	7-1	10-2	13-2	15-9	18-5
	Southern Pine	#3	6-0	8-10	11-3	13-4	15-10	5-4	7-11	10-1	11-11	14-2
	Spruce-Pine-Fir	SS	7-11	12-5	16-5	20-2	23-4	7-11	11-8	14-9	18-0	20-11
	Spruce-Pine-Fir	#1	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas Fir-Larch	SS	7-11	12-6	15-10	19-5	22-6	7-8	11-3	14-2	17-4	20-1
	Douglas Fir-Larch	#1	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-Fir	SS	7-6	11-10	15-7	19-1	22-1	7-6	11-0	13-11	17-0	19-9
	Hem-Fir	#1	6-11	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-Fir	#2	6-7	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern Pine	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-8	23-0
	Southern Pine	#1	7-8	11-9	14-9	17-6	20-11	7-1	10-6	13-2	15-8	18-8
	Southern Pine	#2	7-1	10-2	13-2	15-9	18-5	6-4	9-2	11-9	14-1	16-6
	Southern Pine	#3	5-4	7-11	10-1	11-11	14-2	4-9	7-1	9-0	10-8	12-8
	Spruce-Pine-Fir	SS	7-4	11-7	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#1	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m<sup>2</sup>.



**TABLE 2308.10.3(4)**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
 (Ground Snow Load = 50 pounds per square foot, Ceiling Not Attached to Rafters,  $L/\Delta = 180$ )

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	17-0	20-9	24-10
	Douglas Fir-Larch	#1	8-2	12-0	15-3	18-7	21-7	7-7	11-2	14-1	17-3	20-0
	Douglas Fir-Larch	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-Fir	SS	8-0	12-6	16-6	21-1	25-6	8-0	12-6	16-6	20-4	23-7
	Hem-Fir	#1	7-10	11-9	14-10	18-1	21-0	7-5	10-10	13-9	16-9	19-5
	Hem-Fir	#2	7-5	11-1	14-0	17-2	19-11	7-0	10-3	13-0	15-10	18-5
	Hem-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern Pine	SS	8-4	13-0	17-2	21-11	26-0	8-4	13-0	17-2	21-11	26-0
	Southern Pine	#1	8-2	12-10	16-10	20-3	24-1	8-2	12-6	15-9	18-9	22-4
	Southern Pine	#2	8-0	11-9	15-3	18-2	21-3	7-7	10-11	14-1	16-10	19-9
	Southern Pine	#3	6-2	9-2	11-8	13-9	16-4	5-9	8-5	10-9	12-9	15-2
	Spruce-Pine-Fir	SS	7-10	12-3	16-2	20-8	24-1	7-10	12-3	15-9	19-3	22-4
	Spruce-Pine-Fir	#1	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas Fir-Larch	SS	7-8	12-1	15-10	19-5	22-6	7-8	11-7	14-8	17-11	20-10
	Douglas Fir-Larch	#1	7-1	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-Fir	SS	7-3	11-5	15-0	19-1	22-1	7-3	11-5	14-5	17-8	20-5
	Hem-Fir	#1	6-11	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	#2	6-7	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern Pine	SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	23-10
	Southern Pine	#1	7-5	11-7	14-9	17-6	20-11	7-4	10-10	13-8	16-2	19-4
	Southern Pine	#2	7-1	10-2	13-2	15-9	18-5	6-7	9-5	12-2	14-7	17-1
	Southern Pine	#3	5-4	7-11	10-1	11-11	14-2	4-11	7-4	9-4	11-0	13-1
	Spruce-Pine-Fir	SS	7-1	11-2	14-8	18-0	20-11	7-1	10-9	13-8	16-8	19-4
	Spruce-Pine-Fir	#1	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3

(continued)

**TABLE 2308.10.3(4)—continued**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
**(Ground Snow Load = 50 pounds per square foot, Ceiling Not Attached to Rafters,  $L/\Delta = 180$ )**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	7-3	11-4	14-6	17-8	20-6	7-3	10-7	13-5	16-5	19-0
	Douglas Fir-Larch	#1	6-6	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas Fir-Larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas Fir-Larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-Fir	SS	6-10	10-9	14-2	17-5	20-2	6-10	10-5	13-2	16-1	18-8
	Hem-Fir	#1	6-4	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#2	6-0	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern Pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-7	21-9
	Southern Pine	#1	7-0	10-8	13-5	16-0	19-1	6-8	9-11	12-5	14-10	17-8
	Southern Pine	#2	6-6	9-4	12-0	14-4	16-10	6-0	8-8	11-2	13-4	15-7
	Southern Pine	#3	4-11	7-3	9-2	10-10	12-11	4-6	6-8	8-6	10-1	12-0
	Spruce-Pine-Fir	SS	6-8	10-6	13-5	16-5	19-1	6-8	9-10	12-5	15-3	17-8
	Spruce-Pine-Fir	#1	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas Fir-Larch	SS	6-8	10-3	13-0	15-10	18-4	6-6	9-6	12-0	14-8	17-0
	Douglas Fir-Larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas Fir-Larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas Fir-Larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-Fir	SS	6-4	9-11	12-9	15-7	18-0	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern Pine	SS	6-7	10-4	13-8	17-5	21-0	6-7	10-4	13-8	16-7	19-5
	Southern Pine	#1	6-5	9-7	12-0	14-4	17-1	6-0	8-10	11-2	13-3	15-9
	Southern Pine	#2	5-10	8-4	10-9	12-10	15-1	5-5	7-9	10-0	11-11	13-11
	Southern Pine	#3	4-4	6-5	8-3	9-9	11-7	4-1	6-0	7-7	9-0	10-8
	Spruce-Pine-Fir	SS	6-2	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Spruce-Pine-Fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m<sup>2</sup>.





**TABLE 2308.10.3(5)**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
 (Ground Snow Load = 30 pounds per square foot, Ceiling Attached to Rafters,  $L/\Delta = 240$ )

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	9-1	14-4	18-10	24-1	26-0	9-1	14-4	18-10	24-1	26-0
	Douglas Fir-Larch	#1	8-9	13-9	18-2	22-9	26-0	8-9	13-2	16-8	20-4	23-7
	Douglas Fir-Larch	#2	8-7	13-6	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas Fir-Larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	SS	8-7	13-6	17-10	22-9	26-0	8-7	13-6	17-10	22-9	26-0
	Hem-Fir	#1	8-5	13-3	17-5	22-2	25-9	8-5	12-10	16-3	19-10	23-0
	Hem-Fir	#2	8-0	12-7	16-7	21-0	24-4	8-0	12-2	15-4	18-9	21-9
	Hem-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern Pine	SS	8-11	14-1	18-6	23-8	26-0	8-11	14-1	18-6	23-8	26-0
	Southern Pine	#1	8-9	13-9	18-2	23-2	26-0	8-9	13-9	18-2	22-2	26-0
	Southern Pine	#2	8-7	13-6	17-10	22-3	26-0	8-7	12-11	16-8	19-11	23-4
	Southern Pine	#3	7-7	11-2	14-3	16-10	20-0	6-9	10-0	12-9	15-1	17-11
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	22-3	26-0	8-5	13-3	17-5	22-3	26-0
	Spruce-Pine-Fir	#1	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#2	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	26-0	8-3	13-0	17-2	21-3	24-8
	Douglas Fir-Larch	#1	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas Fir-Larch	#2	7-10	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas Fir-Larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	20-8	24-2
	Hem-Fir	#1	7-8	12-0	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-Fir	#2	7-3	11-5	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern Pine	SS	8-1	12-9	16-10	21-6	26-0	8-1	12-9	16-10	21-6	26-0
	Southern Pine	#1	8-0	12-6	16-6	21-1	25-7	8-0	12-6	16-2	19-2	22-10
	Southern Pine	#2	7-10	12-3	16-2	19-3	22-7	7-10	11-2	14-5	17-3	20-2
	Southern Pine	#3	6-7	9-8	12-4	14-7	17-4	5-10	8-8	11-0	13-0	15-6
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	19-9	22-10
	Spruce-Pine-Fir	#1	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#2	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6

(continued)

**TABLE 2308.10.3(5)—continued**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
**(Ground Snow Load = 30 pounds per square foot, Ceiling Attached to Rafters,  $L/\Delta = 240$ )**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	15-10	19-5	22-6
	Douglas Fir-Larch	#1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#2	7-4	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas Fir-Larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-Fir	SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-Fir	#1	7-2	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-Fir	#2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern Pine	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-2	24-7
	Southern Pine	#1	7-6	11-9	15-6	19-7	23-4	7-6	11-9	14-9	17-6	20-11
	Southern Pine	#2	7-4	11-5	14-9	17-7	20-7	7-1	10-2	13-2	15-9	18-5
	Southern Pine	#3	6-0	8-10	11-3	13-4	15-10	5-4	7-11	10-1	11-11	14-2
	Spruce-Pine-Fir	SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-Pine-Fir	#1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas Fir-Larch	SS	7-3	11-4	15-0	19-1	22-6	7-3	11-3	14-2	17-4	20-1
	Douglas Fir-Larch	#1	7-0	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-Fir	SS	6-10	10-9	14-2	18-0	21-11	6-10	10-9	13-11	17-0	19-9
	Hem-Fir	#1	6-8	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-Fir	#2	6-4	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern Pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-10
	Southern Pine	#1	7-0	10-11	14-5	17-6	20-11	7-0	10-6	13-2	15-8	18-8
	Southern Pine	#2	6-10	10-2	13-2	15-9	18-5	6-4	9-2	11-9	14-1	16-6
	Southern Pine	#3	5-4	7-11	10-1	11-11	14-2	4-9	7-1	9-0	10-8	12-8
	Spruce-Pine-Fir	SS	6-8	10-6	13-10	17-8	20-11	6-8	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#1	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#2	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m<sup>2</sup>.



**TABLE 2308.10.3(6)**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
 (Ground Snow Load = 50 pounds per square foot, Ceiling Attached to Rafters,  $L/\Delta = 240$ )

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-11	20-3	24-0
	Douglas Fir-Larch	#1	7-5	11-7	15-3	18-7	21-7	7-5	11-2	14-1	17-3	20-0
	Douglas Fir-Larch	#2	7-3	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-Fir	SS	7-3	11-5	15-0	19-2	23-4	7-3	11-5	15-0	19-2	23-4
	Hem-Fir	#1	7-1	11-2	14-8	18-1	21-0	7-1	10-10	13-9	16-9	19-5
	Hem-Fir	#2	6-9	10-8	14-0	17-2	19-11	6-9	10-3	13-0	15-10	18-5
	Hem-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern Pine	SS	7-6	11-0	15-7	19-11	24-3	7-6	11-10	15-7	19-11	24-3
	Southern Pine	#1	7-5	11-7	15-4	19-7	23-9	7-5	11-7	15-4	18-9	22-4
	Southern Pine	#2	7-3	11-5	15-0	18-2	21-3	7-3	10-11	14-1	16-10	19-9
	Southern Pine	#3	6-2	9-2	11-8	13-9	16-4	5-9	8-5	10-9	12-9	15-2
	Spruce-Pine-Fir	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-4
	Spruce-Pine-Fir	#1	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#2	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas Fir-Larch	SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	17-11	20-10
	Douglas Fir-Larch	#1	6-9	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas Fir-Larch	#2	6-7	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-Fir	SS	6-7	10-4	13-8	17-5	21-2	6-7	10-4	13-8	17-5	20-5
	Hem-Fir	#1	6-5	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	#2	6-2	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern Pine	SS	6-10	10-9	14-2	18-1	22-0	6-10	10-9	14-2	18-1	22-0
	Southern Pine	#1	6-9	10-7	13-11	17-6	20-11	6-9	10-7	13-8	16-2	19-4
	Southern Pine	#2	6-7	10-2	13-2	15-9	18-5	6-7	9-5	12-2	14-7	17-1
	Southern Pine	#3	5-4	7-11	10-1	11-11	14-2	4-11	7-4	9-4	11-0	13-1
	Spruce-Pine-Fir	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-8	19-4
	Spruce-Pine-Fir	#1	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#2	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3

(continued)

**TABLE 2308.10.3(6)—continued**  
**RAFTER SPANS FOR COMMON LUMBER SPECIES**  
**(Ground Snow Load = 50 pounds per square foot, Ceiling Attached to Rafters,  $L/\Delta = 240$ )**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	6-7	10-4	13-7	17-4	20-6	6-7	10-4	13-5	16-5	19-0
	Douglas Fir-Larch	#1	6-4	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas Fir-Larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas Fir-Larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-Fir	SS	6-2	9-9	12-10	16-5	19-11	6-2	9-9	12-10	16-1	18-8
	Hem-Fir	#1	6-1	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#2	5-9	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern Pine	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	17-0	20-9
	Southern Pine	#1	6-4	9-11	13-1	16-0	19-1	6-4	9-11	12-5	14-10	17-8
	Southern Pine	#2	6-2	9-4	12-0	14-4	16-10	6-0	8-8	11-2	13-4	15-7
	Southern Pine	#3	4-11	7-3	9-2	10-10	12-11	4-6	6-8	8-6	10-1	12-0
	Spruce-Pine-Fir	SS	6-1	9-6	12-7	16-0	19-1	6-1	9-6	12-5	15-3	17-8
	Spruce-Pine-Fir	#1	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#2	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas Fir-Larch	SS	6-1	9-7	12-7	15-10	18-4	6-1	9-6	12-0	14-8	17-0
	Douglas Fir-Larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas Fir-Larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas Fir-Larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-Fir	SS	5-9	9-1	11-11	15-12	18-0	5-9	9-1	11-9	14-5	16-8
	Hem-Fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern Pine	SS	6-0	9-5	12-5	15-10	19-3	6-0	9-5	12-5	15-10	19-3
	Southern Pine	#1	5-10	9-3	12-0	14-4	17-1	5-10	8-10	11-2	13-3	15-9
	Southern Pine	#2	5-9	8-4	10-9	12-10	15-1	5-5	7-9	10-0	11-11	13-11
	Southern Pine	#3	4-4	6-5	8-3	9-9	11-7	4-1	6-0	7-7	9-0	10-8
	Spruce-Pine-Fir	SS	5-8	8-10	11-8	14-8	17-1	5-8	8-10	11-2	13-7	15-9
	Spruce-Pine-Fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m<sup>2</sup>.

**TABLE 2308.10.4.1  
RAFTER TIE CONNECTIONS<sup>g</sup>**

RAFTER SLOPE	TIE SPACING (inches)	NO SNOW LOAD				GROUND SNOW LOAD (pound per square foot)							
						30 pounds per square foot				50 pounds per square foot			
		Roof span (feet)											
		12	20	28	36	12	20	28	36	12	20	28	36
Required number of 16d common (3½" x 0.162") nails <sup>a, b</sup> per connection <sup>c, d, e, f</sup>													
3:12	12	4	6	8	10	4	6	8	11	5	8	12	15
	16	5	7	10	13	5	8	11	14	6	11	15	20
	24	7	11	15	19	7	11	16	21	9	16	23	30
	32	10	14	19	25	10	16	22	28	12	27	30	40
	48	14	21	29	37	14	32	36	42	18	32	46	60
4:12	12	3	4	5	6	3	5	6	8	4	6	9	11
	16	3	5	7	8	4	6	8	11	5	8	12	15
	24	4	7	10	12	5	9	12	16	7	12	17	22
	32	6	9	13	16	8	12	16	22	10	16	24	30
	48	8	14	19	24	10	18	24	32	14	24	34	44
5:12	12	3	3	4	5	3	4	5	7	3	5	7	9
	16	3	4	5	7	3	5	7	9	4	7	9	12
	24	4	6	8	10	4	7	10	13	6	10	14	18
	32	5	8	10	13	6	10	14	18	8	14	18	24
	48	7	11	15	20	8	14	20	26	12	20	28	36
7:12	12	3	3	3	4	3	3	4	5	3	4	5	7
	16	3	3	4	5	3	4	5	6	3	5	7	9
	24	3	4	6	7	3	5	7	9	4	7	10	13
	32	4	6	8	10	4	8	10	12	6	10	14	18
	48	5	8	11	14	6	10	14	18	9	14	20	26
9:12	12	3	3	3	3	3	3	3	4	3	3	4	5
	16	3	3	3	4	3	3	4	5	3	4	5	7
	24	3	3	5	6	3	4	6	7	3	6	8	10
	32	3	4	6	8	4	6	8	10	5	8	10	14
	48	4	6	9	11	5	8	12	14	7	12	16	20
12:12	12	3	3	3	3	3	3	3	3	3	3	3	4
	16	3	3	3	3	3	3	3	4	3	3	4	5
	24	3	3	3	4	3	3	4	6	3	4	6	8
	32	3	3	4	5	3	5	6	8	4	6	8	10
	48	3	4	6	7	4	7	8	12	6	8	12	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m<sup>2</sup>.

a. 40d box (5" x 0.162") or 16d sinker (3¼" x 0.148") nails are permitted to be substituted for 16d common (3½" x 0.162") nails.

b. Nailing requirements are permitted to be reduced 25 percent if nails are clinched.

c. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

d. When intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.

e. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

f. Connected members shall be of sufficient size to prevent splitting due to nailing.

g. For snow loads less than 30 pounds per square foot, the required number of nails is permitted to be reduced by multiplying by the ratio of actual snow load plus 10 divided by 40, but not less than the number required for no snow load.

**2308.10.4.1 Ceiling joist and rafter connections.**

Ceiling joists and rafters shall be nailed to each other and the assembly shall be nailed to the top wall plate in accordance with Tables 2304.9.1 and 2308.10.1. Ceiling joists shall be continuous or securely joined where they meet over interior partitions and fastened to adjacent rafters in accordance with Tables 2308.10.4.1 and 2304.9.1 to provide a continuous rafter tie across the building where such joists are parallel to the rafters. Ceiling joists shall have a bearing surface of not less than  $1\frac{1}{2}$  inches (38 mm) on the top plate at each end.

Where ceiling joists are not parallel to rafters, an equivalent rafter tie shall be installed in a manner to provide a continuous tie across the building, at a spacing of not more than 4 feet (1219 mm) o.c. The connections shall be in accordance with Tables 2308.10.4.1 and 2304.9.1, or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top of the rafter support walls, the ridge formed by these rafters shall also be supported by a girder conforming to Section 2308.4.

Rafter ties shall be spaced not more than 4 feet (1219 mm) o.c. Rafter tie connections shall be based on the equivalent rafter spacing in Table 2308.10.4.1. Where rafter ties are spaced at 32 inches (813 mm) o.c., the number of 16d common nails shall be two times the number specified for rafters spaced 16 inches (406 mm) o.c., with a minimum of four 16d common nails where no snow loads are indicated. Where rafter ties are spaced at 48 inches (1219 mm) o.c., the number of 16d common nails shall be two times the number specified for rafters spaced 24 inches (610 mm) o.c., with a minimum of six 16d common nails where no snow loads are indicated. Rafter/ceiling joist connections and rafter/tie connections shall be of sufficient size and number to prevent splitting from nailing.

**2308.10.4.2 Notches and holes.** Notching at the ends of rafters or ceiling joists shall not exceed one-fourth the depth. Notches in the top or bottom of the rafter or ceiling joist shall not exceed one-sixth the depth and shall not be located in the middle one-third of the span, except that a notch not exceeding one-third of the depth is permitted in the top of the rafter or ceiling joist not further from the face of the support than the depth of the member.

Holes bored in rafters or ceiling joists shall not be within 2 inches (51 mm) of the top and bottom and their diameter shall not exceed one-third the depth of the member.

**2308.10.4.3 Framing around openings.** Trimmer and header rafters shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header rafters more than 6 feet (1829 mm) long shall be supported by framing anchors or rafter hangers unless bearing on a beam, partition or wall.

**2308.10.5 Purlins.** Purlins to support roof loads are permitted to be installed to reduce the span of rafters within allowable limits and shall be supported by struts to bearing walls. The maximum span of 2-inch by 4-inch (51 mm by 102 mm) purlins shall be 4 feet (1219 mm). The maximum span of the 2-inch by 6-inch (51 mm by 152 mm) purlin shall be 6 feet (1829 mm), but in no case shall the purlin be smaller than the supported rafter. Struts shall not be smaller than 2-inch by 4-inch (51 mm by 102 mm) members. The unbraced length of struts shall not exceed 8 feet (2438 mm) and the minimum slope of the struts shall not be less than 45 degrees (0.79 rad) from the horizontal.

**2308.10.6 Blocking.** Roof rafters and ceiling joists shall be supported laterally to prevent rotation and lateral displacement in accordance with the provisions of Section 2308.8.5.

**2308.10.7 Engineered wood products.** Prefabricated wood I-joists, structural glued-laminated timber and structural composite lumber shall not be notched or drilled except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

**2308.10.8 Roof sheathing.** Roof sheathing shall be in accordance with Tables 2304.7(3) and 2304.7(5) for wood structural panels, and Tables 2304.7(1) and 2304.7(2) for lumber and shall comply with Section 2304.7.2.

**2308.10.8.1 Joints.** Joints in lumber sheathing shall occur over supports unless approved end-matched lumber is used, in which case each piece shall bear on at least two supports.

**2308.10.9 Roof planking.** Planking shall be designed in accordance with the general provisions of this code.

In lieu of such design, 2-inch (51 mm) tongue-and-groove planking is permitted in accordance with Table 2308.10.9. Joints in such planking are permitted to be randomly spaced, provided the system is applied to not less than three continuous spans, planks are center matched and end matched or splined, each plank bears on at least one support, and joints are separated by at least 24 inches (610 mm) in adjacent pieces.

**2308.10.10 Wood trusses.** Wood trusses shall be designed in accordance with Section 2303.4.

**2308.10.11 Attic ventilation.** For *attic* ventilation, see Section 1203.2.

**2308.11 Additional requirements for conventional construction in Seismic Design Category B or C.** Structures of conventional light-frame construction and assigned to Seismic Design Category B or C shall comply with Sections 2308.11.1 through 2308.11.3, in addition to the provisions of Sections 2308.1 through 2308.10.

**2308.11.1 Number of stories.** Structures of conventional light-frame construction and assigned to Seismic Design Category C shall not exceed two stories above grade plane.

**TABLE 2308.10.9  
ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING**

SPAN <sup>a</sup> (feet)	LIVE LOAD (pound per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pound per square inch)	MODULUS OF ELASTICITY (E) (pound per square inch)
<b>Roofs</b>				
4	20	1/240 1/360	160	170,000 256,000
	30	1/240 1/360	210	256,000 384,000
	40	1/240 1/360	270	340,000 512,000
4.5	20	1/240 1/360	200	242,000 305,000
	30	1/240 1/360	270	363,000 405,000
	40	1/240 1/360	350	484,000 725,000
5.0	20	1/240 1/360	250	332,000 500,000
	30	1/240 1/360	330	495,000 742,000
	40	1/240 1/360	420	660,000 1,000,000
5.5	20	1/240 1/360	300	442,000 660,000
	30	1/240 1/360	400	662,000 998,000
	40	1/240 1/360	500	884,000 1,330,000
6.0	20	1/240 1/360	360	575,000 862,000
	30	1/240 1/360	480	862,000 1,295,000
	40	1/240 1/360	600	1,150,000 1,730,000

*(continued)*

**2308.11.2 Concrete or masonry.** Concrete or masonry walls and stone or masonry veneer shall not extend above a basement.

**Exceptions:**

1. In structures assigned to Seismic Design Category B, stone and masonry veneer is permitted to be used in the first two stories above grade plane or the first three stories above grade plane where the lowest story has concrete or masonry walls, provided that structural use panel wall bracing is used and the length of bracing provided is one-and one-half times the required length as determined in Table 2308.9.3(1).
2. In structures assigned to Seismic Design Category B or C, stone and masonry veneer is permitted to be used in the first story above grade plane or the first two stories above grade plane where the lowest story has concrete or masonry walls.
3. In structures assigned to Seismic Design Category B or C, stone and masonry veneer is permitted to be used in both stories of buildings with

two stories above grade plane, provided the following criteria are met:

- 3.1. Type of brace per Section 2308.9.3 shall be Method 3 and the allowable shear capacity in accordance with Section 2306.3 shall be a minimum of 350 plf (5108 N/m).
- 3.2. Braced wall panels in the second story shall be located in accordance with Section 2308.9.3 and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 25 percent of the braced wall line length. Braced wall panels in the first story shall be located in accordance with Section 2308.9.3 and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 45 percent of the braced wall line length.
- 3.3. Hold-down connectors shall be provided at the ends of each braced wall panel for

**TABLE 2308.10.9—continued**  
**ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING**

SPAN <sup>a</sup> (feet)	LIVE LOAD (pound per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pound per square inch)	MODULUS OF ELASTICITY (E) (pound per square inch)
<b>Roofs</b>				
6.5	20	1/240 1/360	420	595,000 892,000
	30	1/240 1/360	560	892,000 1,340,000
	40	1/240 1/360	700	1,190,000 1,730,000
7.0	20	1/240 1/360	490	910,000 1,360,000
	30	1/240 1/360	650	1,370,000 2,000,000
	40	1/240 1/360	810	1,820,000 2,725,000
7.5	20	1/240 1/360	560	1,125,000 1,685,000
	30	1/240 1/360	750	1,685,000 2,530,000
	40	1/240 1/360	930	2,250,000 3,380,000
8.0	20	1/240 1/360	640	1,360,000 2,040,000
	30	1/240 1/360	850	2,040,000 3,060,000
<b>Floors</b>				
4	40	1/360	840	1,000,000
4.5			950	1,300,000
5.0			1,060	1,600,000

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>, 1 pound per square inch = 0.00689 N/mm<sup>2</sup>.

a. Spans are based on simple beam action with 10 pounds per square foot dead load and provisions for a 300-pound concentrated load on a 12-inch width of decking. Random layout is permitted in accordance with the provisions of Section 2308.10.9. Lumber thickness is 1½ inches nominal.

the second story to first story connection with an allowable capacity of 2,000 pounds (8896 N). Hold-down connectors shall be provided at the ends of each braced wall panel for the first story to foundation connection with an allowable capacity of 3,900 pounds (17 347 N). In all cases, the hold-down connector force shall be transferred to the foundation.

3.4. Cripple walls shall not be permitted.

**2308.11.3 Framing and connection details.** Framing and connection details shall conform to Sections 2308.11.3.1 through 2308.11.3.3.

**2308.11.3.1 Anchorage.** Braced wall lines shall be anchored in accordance with Section 2308.6 at foundations.

**2308.11.3.2 Stepped footings.** Where the height of a required braced wall panel extending from foundation to floor above varies more than 4 feet (1219 mm), the following construction shall be used:

1. Where the bottom of the footing is stepped and the lowest floor framing rests directly on a sill bolted to the footings, the sill shall be anchored as required in Section 2308.3.3.
2. Where the lowest floor framing rests directly on a sill bolted to a footing not less than 8 feet (2438 mm) in length along a line of bracing, the line shall be considered to be braced. The double plate of the cripple stud wall beyond the segment of footing extending to the lowest framed floor shall be spliced to the sill plate with metal ties, one on each side of the sill and plate. The metal ties shall not be less than 0.058 inch [1.47 mm (16 galvanized gage)] by 1½ inches (38 mm) wide by 48 inches (1219 mm) with eight 16d common nails on each side of the splice location (see Figure 2308.11.3.2). The metal tie shall have a minimum yield of 33,000 pounds per square inch (psi) (227 MPa).
3. Where cripple walls occur between the top of the footing and the lowest floor framing, the bracing requirements for a story shall apply.



**2308.11.3.3 Openings in horizontal diaphragms.**

Openings in horizontal diaphragms with a dimension perpendicular to the joist that is greater than 4 feet (1219 mm) shall be constructed in accordance with the following:

1. Blocking shall be provided beyond headers.
2. Metal ties not less than 0.058 inch [1.47 mm (16 galvanized gage)] by 1½ inches (38 mm) wide with eight 16d common nails on each side of the header-joist intersection shall be provided (see Figure 2308.11.3.3). The metal ties shall have a minimum yield of 33,000 psi (227 MPa).

**2308.12 Additional requirements for conventional construction in Seismic Design Category D or E.** Structures of conventional light-frame construction and assigned to Seismic Design Category D or E shall conform to Sections 2308.12.1 through 2308.12.9, in addition to the requirements for structures assigned to Seismic Design Category B or C in Section 2308.11.

**2308.12.1 Number of stories.** Structures of conventional light-frame construction and assigned to Seismic Design Category D or E shall not exceed one story above grade plane.

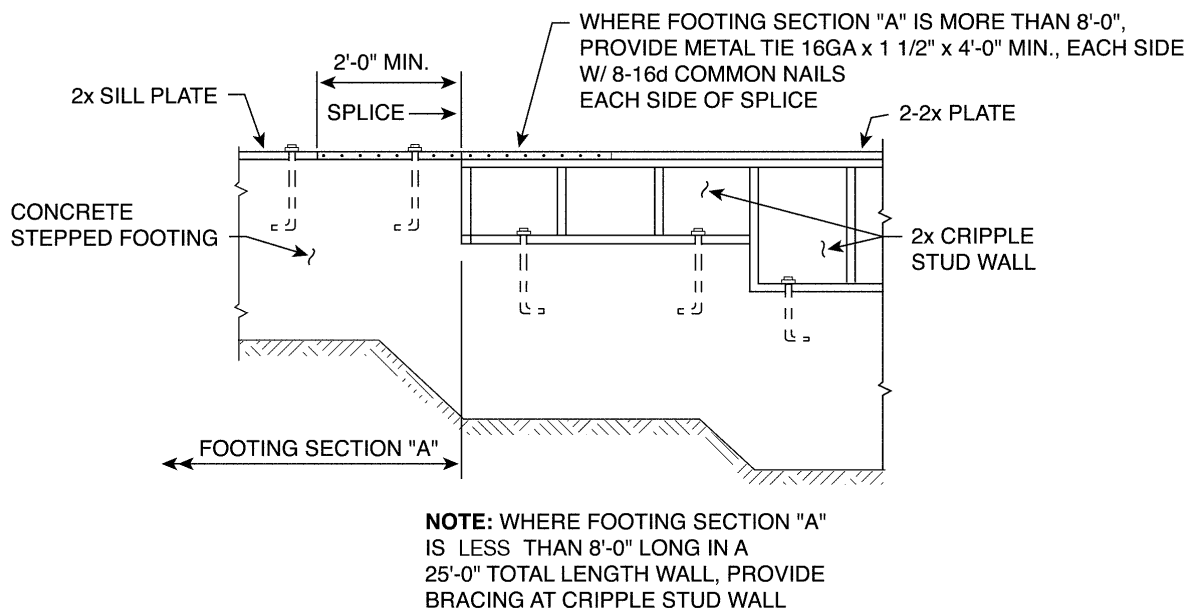
**2308.12.2 Concrete or masonry.** Concrete or masonry walls and stone or masonry veneer shall not extend above a basement.

**Exception:** In structures assigned to Seismic Design Category D, stone and masonry veneer is permitted to be used in the first story above grade plane, provided the following criteria are met:

1. Type of brace in accordance with Section 2308.9.3 shall be Method 3 and the allowable shear capacity in accordance with Section 2306.3 shall be a minimum of 350 plf (5108 N/m).
2. The bracing of the first story shall be located at each end and at least every 25 feet (7620 mm) o.c. but not less than 45 percent of the braced wall line.
3. Hold-down connectors shall be provided at the ends of braced walls for the first floor to foundation with an allowable capacity of 2,100 pounds (9341 N).
4. Cripple walls shall not be permitted.

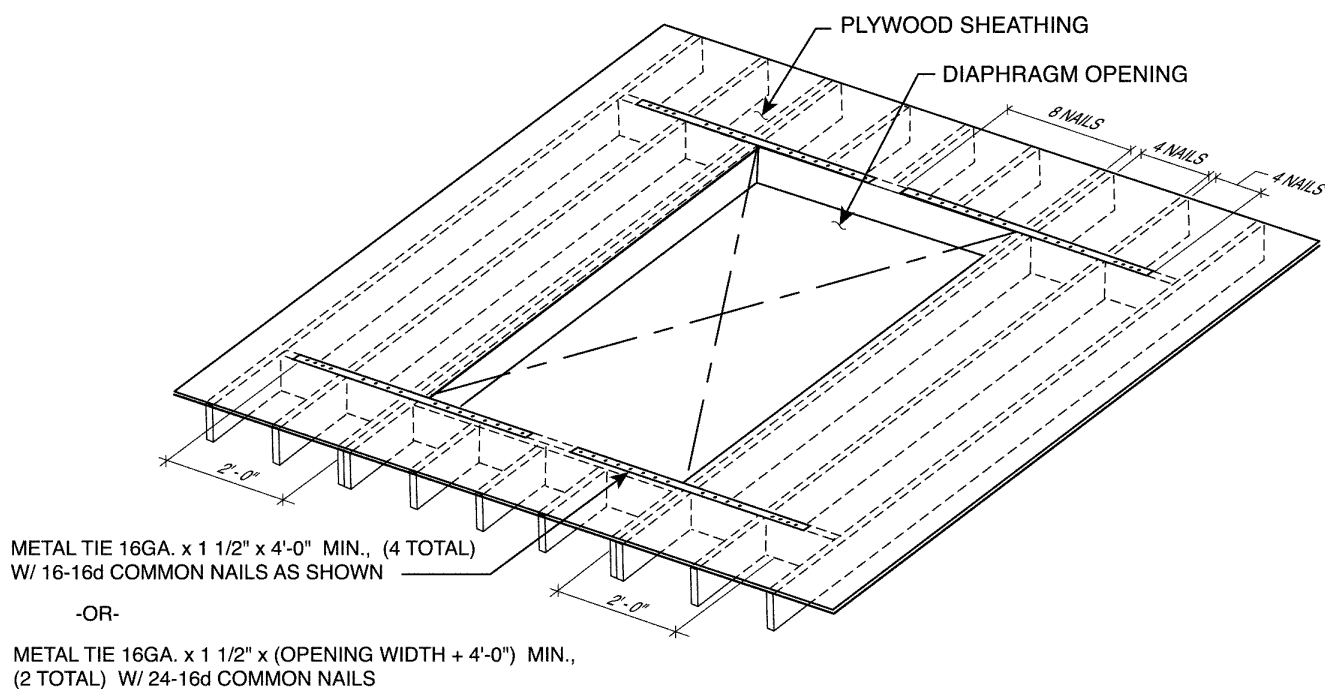
**2308.12.3 Braced wall line spacing.** Spacing between interior and exterior braced wall lines shall not exceed 25 feet (7620 mm).

**2308.12.4 Braced wall line sheathing.** Braced wall lines shall be braced by one of the types of sheathing prescribed by Table 2308.12.4 as shown in Figure 2308.9.3. The sum of lengths of braced wall panels at each braced wall line shall conform to the required percentage of wall length required to be braced per braced wall line in Table 2308.12.4. Braced wall panels shall be distributed along the length of the braced wall line and start at not more than 8 feet (2438 mm) from each end of the braced wall line. Panel sheathing joints shall occur over studs or blocking. Sheathing shall be fastened to studs, top and bottom plates and at panel edges occurring over blocking. Wall framing to which sheathing used for bracing is applied shall be nominal 2-inch-wide [actual 1½ inch (38 mm)] or larger members.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE 2308.11.3.2**  
**STEPPED FOOTING CONNECTION DETAILS**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE 2308.11.3.3**  
**OPENINGS IN HORIZONTAL DIAPHRAGMS**

Cripple walls having a stud height exceeding 14 inches (356 mm) shall be considered a story for the purpose of this section and shall be braced as required for braced wall lines in accordance with the required percentage of wall length required to be braced per braced wall line in Table 2308.12.4. Where interior braced wall lines occur without a continuous foundation below, the length of parallel exterior cripple wall bracing shall be one and one-half times the lengths required by Table 2308.12.4. Where the cripple wall sheathing type used is Type S-W and this additional length of bracing cannot be provided, the capacity of Type S-W sheathing shall be increased by reducing the spacing of fasteners along the perimeter of each piece of sheathing to 4 inches (102 mm) o.c.

**2308.12.4.1 Alternative bracing.** An alternate braced wall panel constructed in accordance with Section 2308.9.3.1 or 2308.9.3.2 is permitted to be substituted for a braced wall panel in Section 2308.9.3 Items 2 through 8. For methods 2, 3, 4, 6, 7 and 8, each 48-inch (1219 mm) section or portion thereof required by Table 2308.12.4 is permitted to be replaced by one alternate braced wall panel constructed in accordance with Section 2308.9.3.1 or 2308.9.3.2. For method 5, each 96-inch (2438 mm) section (applied to one face) or 48-inch (1219 mm) section (applied to both faces) or portion thereof required by Table 2308.12.4 is permitted to be replaced by one alternate braced wall

panel constructed in accordance with Section 2308.9.3.1 or 2308.9.3.2.

**2308.12.5 Attachment of sheathing.** Fastening of braced wall panel sheathing shall not be less than that prescribed in Table 2308.12.4 or 2304.9.1. Wall sheathing shall not be attached to framing members by adhesives.

**2308.12.6 Irregular structures.** Conventional light-frame construction shall not be used in irregular portions of structures assigned to Seismic Design Category D or E. Such irregular portions of structures shall be designed to resist the forces specified in Chapter 16 to the extent such irregular features affect the performance of the conventional framing system. A portion of a structure shall be considered to be irregular where one or more of the conditions described in Items 1 through 6 below are present.

1. Where exterior braced wall panels are not in one plane vertically from the foundation to the uppermost story in which they are required, the structure shall be considered to be irregular [see Figure 2308.12.6(1)].

**Exception:** Floors with cantilevers or setbacks not exceeding four times the nominal depth of the floor joists [see Figure 2308.12.6(2)] are permitted to support braced wall panels provided:

1. Floor joists are 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) o.c.

2. The ratio of the back span to the cantilever is at least 2:1.
  3. Floor joists at ends of braced wall panels are doubled.
  4. A continuous rim joist is connected to the ends of cantilevered joists. The rim joist is permitted to be spliced using a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and 1½ inches (38 mm) wide fastened with six 16d common nails on each side. The metal tie shall have a minimum yield of 33,000 psi (227 MPa).
  5. Joists at setbacks or the end of cantilevered joists shall not carry gravity loads from more than a single story having uniform wall and roof loads, nor carry the reactions from headers having a span of 8 feet (2438 mm) or more.
2. Where a section of floor or roof is not laterally supported by braced wall lines on all edges and connected in accordance with Section 2308.3.2, the structure shall be considered to be irregular [see Figure 2308.12.6(3)].

**Exception:** Portions of roofs or floors that do not support braced wall panels above are permitted to extend up to 6 feet (1829 mm) beyond a braced wall line [see Figure 2308.12.6(4)] provided that the framing members are connected to the braced wall line below in accordance with Section 2308.3.2.

3. Where the end of a required braced wall panel extends more than 1 foot (305 mm) over an opening in the wall below, the structure shall be considered to be irregular. This requirement is applicable to braced wall panels offset in plane and to braced wall

panels offset out of plane as permitted by the exception to Item 1 above in this section [see Figure 2308.12.6(5)].

**Exception:** Braced wall panels are permitted to extend over an opening not more than 8 feet (2438 mm) in width where the header is a 4-inch by 12-inch (102 mm by 305 mm) or larger member.

4. Where portions of a floor level are vertically offset such that the framing members on either side of the offset cannot be lapped or tied together in an approved manner, the structure shall be considered to be irregular [see Figure 2308.12.6(6)].

**Exception:** Framing supported directly by foundations need not be lapped or tied directly together.

5. Where braced wall lines are not perpendicular to each other, the structure shall be considered to be irregular [see Figure 2308.12.6(7)].
6. Where openings in floor and roof diaphragms having a maximum dimension greater than 50 percent of the distance between lines of bracing or an area greater than 25 percent of the area between orthogonal pairs of braced wall lines are present, the structure shall be considered to be irregular [see Figure 2308.12.6(8)].

**2308.12.7 Anchorage of exterior means of egress components.** Exterior egress balconies, exterior exit stairways and similar means of egress components shall be positively anchored to the primary structure at not over 8 feet (2438 mm) o.c. or shall be designed for lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

**TABLE 2308.12.4**  
**WALL BRACING IN SEISMIC DESIGN CATEGORIES D AND E**  
**(Minimum Percentage of Wall Bracing per each Braced Wall Line<sup>a</sup>)**

CONDITION	SHEATHING TYPE <sup>b</sup>	$S_{DS} < 0.50$	$0.50 \leq S_{DS} < 0.75$	$0.75 \leq S_{DS} \leq 1.00$	$S_{DS} > 1.00$
One story	G-P <sup>c</sup>	43	59	75	100
	S-W	21	32	37	48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Minimum length of panel bracing of one face of the wall for S-W sheathing or both faces of the wall for G-P sheathing; h/w ratio shall not exceed 2:1. For S-W panel bracing of the same material on two faces of the wall, the minimum length is permitted to be one-half the tabulated value but the h/w ratio shall not exceed 2:1 and design for uplift is required. The 2:1 h/w ratio limitation does not apply to alternate braced wall panels constructed in accordance with Section 2308.9.3.1 or 2308.9.3.2.
- b. G-P = gypsum board, fiberboard, particleboard, lath and plaster or gypsum sheathing boards; S-W = wood structural panels and diagonal wood sheathing.
- c. Nailing as specified below shall occur at all panel edges at studs, at top and bottom plates and, where occurring, at blocking:
  - For ½-inch gypsum board, 5d (0.113 inch diameter) cooler nails at 7 inches on center;
  - For ⅝-inch gypsum board, No. 11 gage (0.120 inch diameter) at 7 inches on center;
  - For gypsum sheathing board, 1⅜ inches long by ⅞-inch head, diamond point galvanized nails at 4 inches on center;
  - For gypsum lath, No. 13 gage (0.092 inch) by 1⅞ inches long, ⅞-inch head, plasterboard at 5 inches on center;
  - For Portland cement plaster, No. 11 gage (0.120 inch) by 1½ inches long, ⅞-inch head at 6 inches on center;
  - For fiberboard and particleboard, No. 11 gage (0.120 inch) by 1½ inches long, ⅞-inch head, galvanized nails at 3 inches on center.

**2308.12.8 Sill plate anchorage.** Sill plates shall be anchored with anchor bolts with steel plate washers between the foundation sill plate and the nut, or approved anchor straps load rated in accordance with Section 1716.1. Such washers shall be a minimum of 0.229 inch by 3 inches by 3 inches (5.82 mm by 76 mm by 76 mm) in size. The hole in the plate washer is permitted to be diagonally slotted with a width of up to  $\frac{3}{16}$  inch (4.76 mm) larger than the bolt diameter and a slot length not to exceed  $1\frac{3}{4}$  inches (44 mm), provided a standard cut washer is placed between the plate washer and the nut.

**2308.12.9 Sill plate anchorage in Seismic Design Category E.** In structures assigned to Seismic Design Category E, steel bolts with a minimum nominal diameter of  $\frac{5}{8}$  inch (15.9 mm) or approved anchor straps load rated in accordance with Section 1711.1 and spaced to provide equivalent anchorage shall be used.

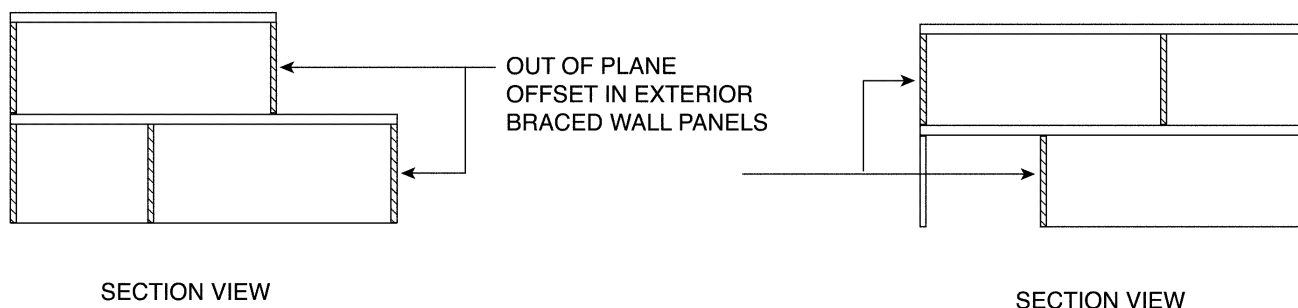
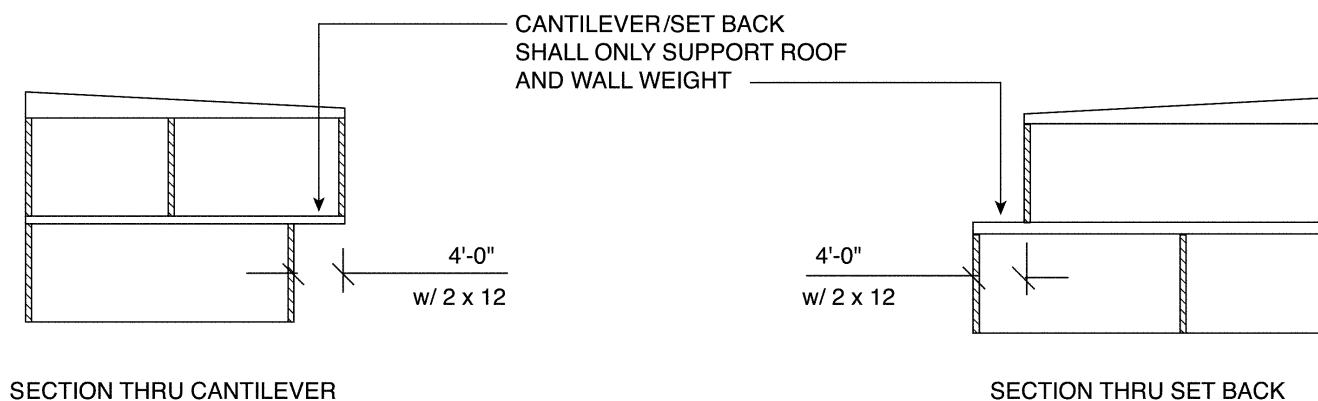
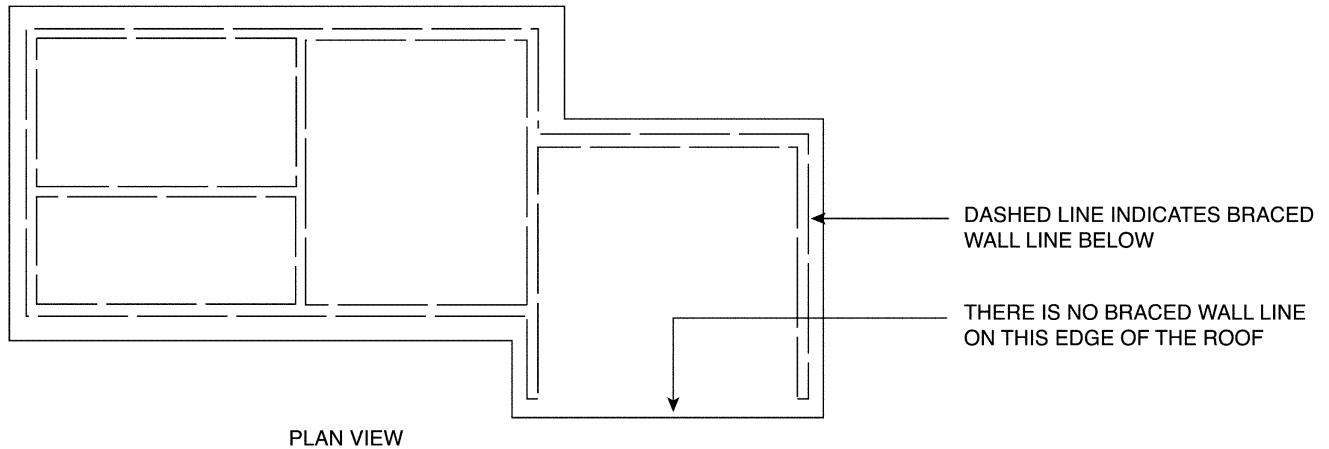


FIGURE 2308.12.6(1)  
BRACED WALL PANELS OUT OF PLANE

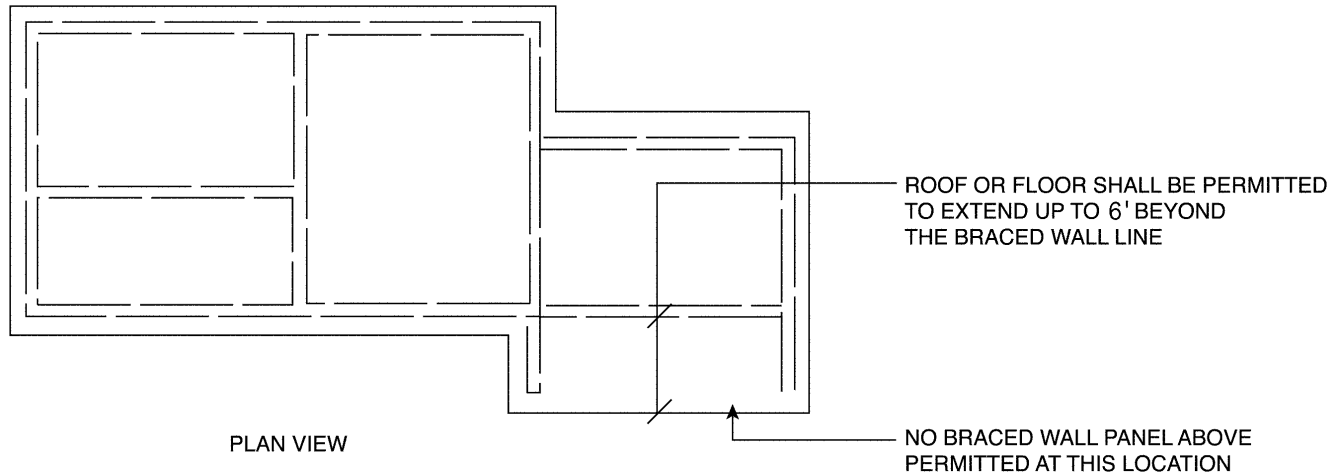


For SI: 1 foot = 304.8 mm.

FIGURE 2308.12.6(2)  
BRACED WALL PANELS SUPPORTED BY CANTILEVER OR SET BACK

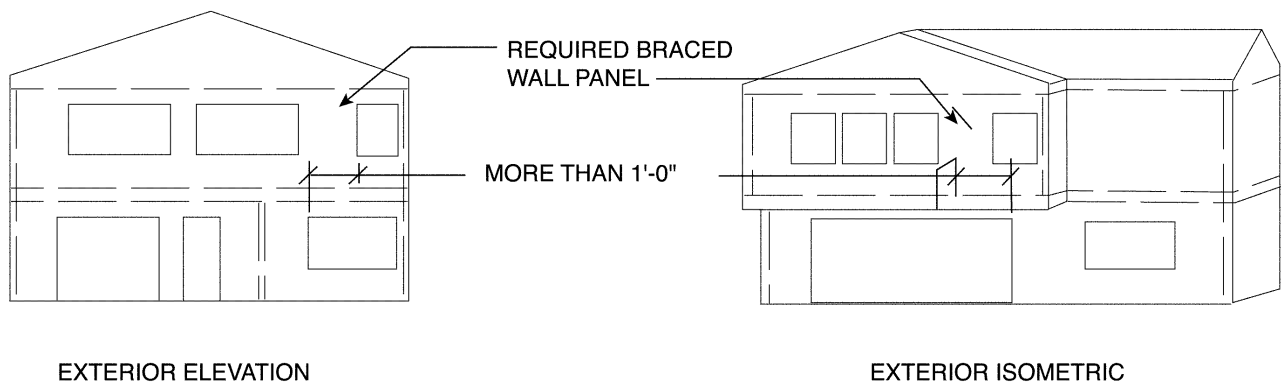


**FIGURE 2308.12.6(3)**  
**FLOOR OR ROOF NOT SUPPORTED ON ALL EDGES**



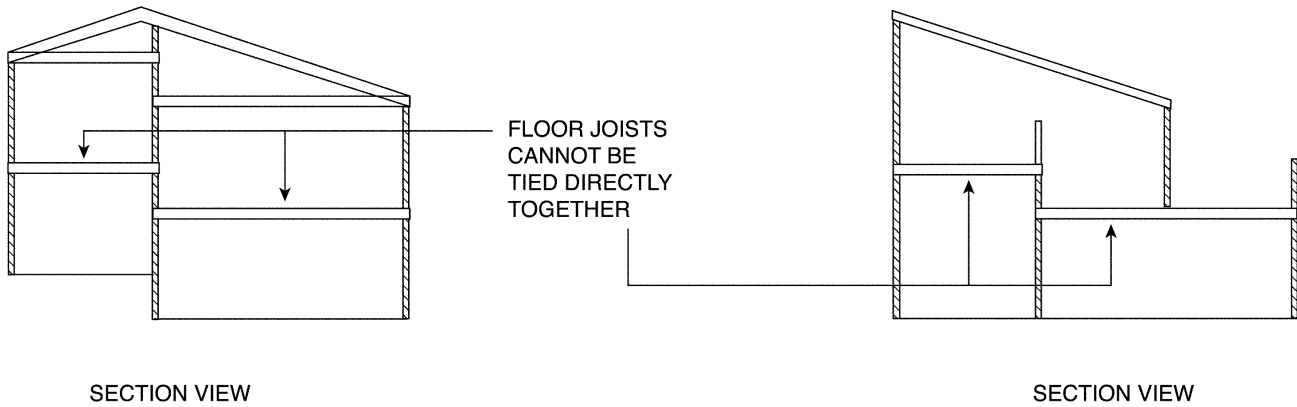
For SI: 1 foot = 304.8 mm.

**FIGURE 2308.12.6(4)**  
**ROOF OR FLOOR EXTENSION BEYOND BRACED WALL LINE**

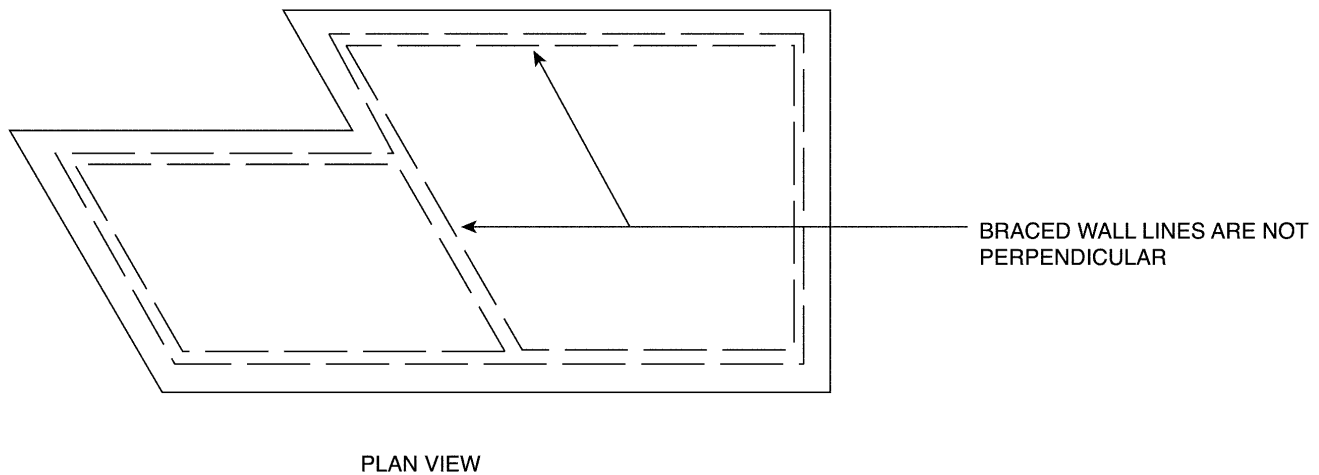


For SI: 1 foot = 304.8 mm.

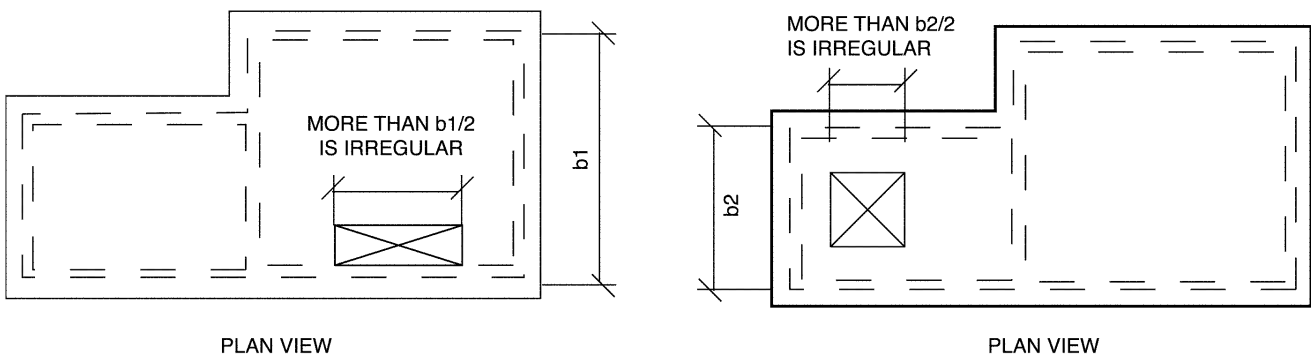
**FIGURE 2308.12.6(5)**  
**BRACED WALL PANEL EXTENSION OVER OPENING**



**FIGURE 2308.12.6(6)**  
**PORTIONS OF FLOOR LEVEL OFFSET VERTICALLY**



**FIGURE 2308.12.6(7)**  
**BRACED WALL LINES NOT PERPENDICULAR**



**FIGURE 2308.12.6(8)**  
**OPENING LIMITATIONS FOR FLOOR AND ROOF DIAPHRAGMS**



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 24 – GLASS AND GLAZING

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>	X		X	X						X										
<i>Adopt entire chapter as amended (amended sections listed below)</i>							X	X												
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
<i>2403.2.1</i>							X	X	X			X								
<i>Table 2403.2.1</i>							X	X	X			X								
<i>2410 &amp; Subsections</i>							X	X	X			X								





## CHAPTER 24

# GLASS AND GLAZING

### SECTION 2401 GENERAL

**2401.1 Scope.** The provisions of this chapter shall govern the materials, design, construction and quality of glass, light-transmitting ceramic and light-transmitting plastic panels for exterior and interior use in both vertical and sloped applications in buildings and structures.

**2401.2 Glazing replacement.** The installation of replacement glass shall be as required for new installations.

### SECTION 2402 DEFINITIONS

**2402.1 Definitions.** The following terms are defined in Chapter 2:

**DALLE GLASS.**

**DECORATIVE GLASS.**

### SECTION 2403 GENERAL REQUIREMENTS FOR GLASS

**2403.1 Identification.** Each pane shall bear the manufacturer's mark designating the type and thickness of the glass or glazing material. The identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance

with approved construction documents that comply with the provisions of this chapter. Safety glazing shall be identified in accordance with Section 2406.3.

Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

Tempered spandrel glass shall be provided with a removable paper marking by the manufacturer.

**2403.2 Glass supports.** Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings and analysis or test data assuring safe performance for the specific installation shall be prepared by a registered design professional.

**2403.2.1 Additional Requirements.** [DSA-SS, DSA-SS/CC and OSHPD 1 & 4] In addition to the requirements of Section 2403.2, glass supports shall comply with the following:

1. The construction documents and analysis or test data required per Section 2403.2 shall be submitted to the enforcement agency for approval.
2. Glass firmly supported on all four edges shall be glazed with minimum laps and edge clearances set forth in Table 2403.2.1.

**TABLE 2403.2.1  
MINIMUM GLAZING REQUIREMENTS**

FIXED WINDOWS AND OPENABLE WINDOWS OTHER THAN HORIZONTAL SIDING					
Glass Area	Up to 6 sq. ft.	6 to 14 sq. ft.	14 to 32 sq. ft.	32 to 50 sq. ft.	Over 50 sq. ft.
× 0.0929 for m <sup>2</sup> , × 25.4 for mm					
1. Minimum Frame Lap	1/4"	1/4"	5/16"	3/8"	1/2"
2. Minimum Glass Edge Clearance	1/8" <sup>1,2</sup>	1/8" <sup>1,2</sup>	3/16" <sup>1</sup>	1/4"	1/4" <sup>1</sup>
3. Continuous Glazing Rabbet and Glass Retainer <sup>3</sup>	Required				
4. Resilient Setting Material <sup>4</sup>	Not Required	Required			
SLIDING DOORS AND HORIZONTAL SLIDING WINDOWS					
Glass Area		Up to 14 sq. ft.	14 to 32 sq. ft.	32 to 50 sq. ft.	Over 50 sq. ft.
× 0.0929 for m <sup>2</sup> , × 25.4 for mm					
5. Minimum Glass Frame Lap		1/4"	5/16"	3/8"	1/2"
6. Minimum Glass Edge Clearance		1/8" <sup>2</sup>	3/16"	1/4"	1/4"
7. Continuous Glazing Rabbet and Glass Retainer <sup>3</sup>		Required above third story	Required		
8. Resilient Setting Material <sup>4</sup>		Not Required		Required	

1. Glass edge clearance in fixed openings shall not be less than required to provide for wind and earthquake drift.
2. Glass edge clearance at all sides of pane shall be a minimum of 3/16 inch (4.8 mm) where height of glass exceeds 3 feet (914 mm).
3. Glass retainers such as metal, wood or vinyl face stops, glazing beads, gaskets, glazing clips and glazing channels shall be of sufficient strength and fixation to serve this purpose.
4. Resilient setting material shall include preformed rubber or vinyl plastic gaskets or other materials which are proved to the satisfaction of the building official to remain resilient.

**2403.3 Framing.** To be considered firmly supported, the framing members for each individual pane of glass shall be designed so the deflection of the edge of the glass perpendicular to the glass pane shall not exceed  $1/175$  of the glass edge length or  $3/4$  inch (19.1 mm), whichever is less, when subjected to the larger of the positive or negative load where loads are combined as specified in Section 1605.

**2403.4 Interior glazed areas.** Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall not be greater than the thickness of the panels when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.

**2403.5 Louvered windows or жалousies.** Float, wired and patterned glass in louvered windows and жалousies shall be no thinner than nominal  $3/16$  inch (4.8 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

Wired glass with wire exposed on longitudinal edges shall not be used in louvered windows or жалousies.

Where other glass types are used, the design shall be submitted to the building official for approval.

## SECTION 2404 WIND, SNOW, SEISMIC AND DEAD LOADS ON GLASS

**2404.1 Vertical glass.** Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding. Glass in glazed curtain walls, glazed storefronts and glazed partitions shall meet the seismic requirements of ASCE 7, Section 13.5.9. The load resistance of glass under uniform load shall be determined in accordance with ASTM E 1300.

The design of vertical glazing shall be based on the following equation:

$$F_{gw} \leq F_{ga} \quad \text{(Equation 24-1)}$$

where:

$F_{gw}$  = Wind load on the glass computed in accordance with Section 1609.

$F_{ga}$  = Short duration load on the glass as determined in accordance with ASTM E 1300.

**2404.2 Sloped glass.** Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunrooms, sloped roofs and other exterior applications shall be designed to resist the most critical of the following combinations of loads.

$$F_g = W_o - D \quad \text{(Equation 24-2)}$$

$$F_g = W_i + D + 0.5 S \quad \text{(Equation 24-3)}$$

$$F_g = 0.5 W_i + D + S \quad \text{(Equation 24-4)}$$

where:

$D$  = Glass dead load psf (kN/m<sup>2</sup>).

For glass sloped 30 degrees (0.52 rad) or less from horizontal,

$$= 13 t_g \text{ (For SI: } 0.0245 t_g \text{)}.$$

For glass sloped more than 30 degrees (0.52 rad) from horizontal,

$$= 13 t_g \cos \theta \text{ (For SI: } 0.0245 t_g \cos \theta \text{)}.$$

$F_g$  = Total load, psf (kN/m<sup>2</sup>) on glass.

$S$  = Snow load, psf (kN/m<sup>2</sup>) as determined in Section 1608.

$t_g$  = Total glass thickness, inches (mm) of glass panes and plies.

$W_i$  = Inward wind force, psf (kN/m<sup>2</sup>) as calculated in Section 1609.

$W_o$  = Outward wind force, psf (kN/m<sup>2</sup>) as calculated in Section 1609.

$\theta$  = Angle of slope from horizontal.

**Exception:** Unit skylights shall be designed in accordance with Section 2405.5.

The design of sloped glazing shall be based on the following equation:

$$F_g \leq F_{ga} \quad \text{(Equation 24-5)}$$

where:

$F_g$  = Total load on the glass determined from the load combinations above.

$F_{ga}$  = Short duration load resistance of the glass as determined according to ASTM E 1300 for Equations 24-2 and 24-3; or the long duration load resistance of the glass as determined according to ASTM E 1300 for Equation 24-4.

### 2404.3 Wired, patterned and sandblasted glass.

**2404.3.1 Vertical wired glass.** Wired glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$$F_{gw} < 0.5 F_{ge} \quad \text{(Equation 24-6)}$$

where:

$F_{gw}$  = Is the wind load on the glass computed per Section 1609.

$F_{ge}$  = Nonfactored load from ASTM E 1300 using a thickness designation for monolithic glass that is not greater than the thickness of wired glass.

**2404.3.2 Sloped wired glass.** Wired glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$$F_g < 0.5 F_{ge} \quad \text{(Equation 24-7)}$$

For Equation 24-4:

$$F_g < 0.3 F_{ge} \quad \text{(Equation 24-8)}$$

where:

$F_g$  = Total load on the glass.

$F_{ge}$  = Nonfactored load from ASTM E 1300.

**2404.3.3 Vertical patterned glass.** Patterned glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$$F_{gw} < 1.0 F_{ge} \quad (\text{Equation 24-9})$$

where:

$F_{gw}$  = Wind load on the glass computed per Section 1609.

$F_{ge}$  = Nonfactored load from ASTM E 1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between nonfactored load charts in ASTM E 1300 shall be permitted.

**2404.3.4 Sloped patterned glass.** Patterned glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$$F_g < 1.0 F_{ge} \quad (\text{Equation 24-10})$$

For Equation 24-4:

$$F_g < 0.6 F_{ge} \quad (\text{Equation 24-11})$$

where

$F_g$  = Total load on the glass.

$F_{ge}$  = Nonfactored load from ASTM E 1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between the nonfactored load charts in ASTM E 1300 shall be permitted.

**2404.3.5 Vertical sandblasted glass.** Sandblasted glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors, and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$$F_g < 0.5 F_{ge} \quad (\text{Equation 24-12})$$

where:

$F_g$  = Total load on the glass.

$F_{ge}$  = Nonfactored load from ASTM E 1300. The value for sandblasted glass is for moderate levels of sandblasting.

**2404.4 Other designs.** For designs outside the scope of this section, an analysis or test data for the specific installation shall be prepared by a registered design professional.

## SECTION 2405 SLOPED GLAZING AND SKYLIGHTS

**2405.1 Scope.** This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope more than 15 degrees (0.26 rad) from the

vertical plane, including glazing materials in skylights, roofs and sloped walls.

**2405.2 Allowable glazing materials and limitations.** Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1 above.

Annealed glass is permitted to be used as specified within Exceptions 2 and 3 of Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. Glass-block construction shall conform to the requirements of Section 2101.2.5.

**2405.3 Screening.** Where used in monolithic glazing systems, heat-strengthened glass and fully tempered glass shall have screens installed below the glazing material. The screens and their fastenings shall: (1) be capable of supporting twice the weight of the glazing; (2) be firmly and substantially fastened to the framing members and (3) be installed within 4 inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. Heat-strengthened glass, fully tempered glass and wired glass, when used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

**Exception:** In monolithic and multiple-layer sloped glazing systems, the following applies:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 feet (3048 mm) or less above the walking surface.
2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.
4. Screens shall not be required within individual dwelling units in Groups R-2, R-3 and R-4 where

fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met:

- 4.1. Each pane of the glass is 16 square feet (1.5 m<sup>2</sup>) or less in area.
- 4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.
- 4.3. The glass thickness is  $\frac{3}{16}$  inch (4.8 mm) or less.
5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used within individual dwelling units in Groups R-2, R-3 and R-4 within the following limits:
  - 5.1. Each pane of glass is 16 square feet (1.5 m<sup>2</sup>) or less in area.
  - 5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

**2405.4 Framing.** In Type I and II construction, sloped glazing and skylight frames shall be constructed of noncombustible materials. In structures where acid fumes deleterious to metal are incidental to the use of the buildings, approved pressure-treated wood or other approved noncorrosive materials are permitted to be used for sash and frames. Framing supporting sloped glazing and skylights shall be designed to resist the tributary roof loads in Chapter 16. Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted at least 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame. Skylights shall not be installed in the plane of the roof where the roof pitch is less than 45 degrees (0.79 rad) from the horizontal.

**Exception:** Installation of a skylight without a curb shall be permitted on roofs with a minimum slope of 14 degrees (three units vertical in 12 units horizontal) in Group R-3 occupancies. All unit skylights installed in a roof with a pitch flatter than 14 degrees (0.25 rad) shall be mounted at least 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame unless otherwise specified in the manufacturer's installation instructions.

**2405.5 Unit skylights.** Unit skylights shall be tested and labeled as complying with AAMA/WDMA/CSA 101/I.S./A440. The label shall state the name of the manufacturer, the approved labeling agency, the product designation and the performance grade rating as specified in AAMA/WDMA/CSA 101/I.S.2/A440. If the product manufacturer has chosen to have the performance grade of the skylight rated separately for positive and negative design pressure, then the label shall state both performance grade ratings as specified in AAMA/WDMA/CSA 101/I.S.2/A440 and the skylight shall comply with Section 2405.5.2. If the skylight is not rated separately for positive and negative pressure, then the performance grade rating shown on the label shall be the performance grade rating determined in accordance with AAMA/WDMA/

CSA 101/I.S.2/A440 for both positive and negative design pressure and the skylight shall conform to Section 2405.5.1.

**2405.5.1 Unit skylights rated for the same performance grade for both positive and negative design pressure.** The design of unit skylights shall be based on the following equation:

$$F_g \leq PG \quad \text{(Equation 24-13)}$$

where:

$F_g$  = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

$PG$  = Performance grade rating of the skylight.

**2405.5.2 Unit skylights rated for separate performance grades for positive and negative design pressure.** The design of unit skylights rated for performance grade for both positive and negative design pressures shall be based on the following equations:

$$F_{gi} \leq PG_{Po} \quad \text{(Equation 24-14)}$$

$$F_{go} \leq PG_{Ne} \quad \text{(Equation 24-15)}$$

where:

$PG_{Pos}$  = Performance grade rating of the skylight under positive design pressure;

$PG_{Neg}$  = Performance grade rating of the skylight under negative design pressure; and

$F_{gi}$  and  $F_{go}$  are determined in accordance with the following:

For  $W_o \geq D$ ,

where:

$W_o$  = Outward wind force, psf (kN/m<sup>2</sup>) as calculated in Section 1609.

$D$  = The dead weight of the glazing, psf (kN/m<sup>2</sup>) as determined in Section 2404.2 for glass, or by the weight of the plastic, psf (kN/m<sup>2</sup>) for plastic glazing.

$F_{gi}$  = Maximum load on the skylight determined from Equations 24-3 and 24-4 in Section 2404.2.

$F_{go}$  = Maximum load on the skylight determined from Equation 24-2.

For  $W_o < D$ ,

where:

$W_o$  = Is the outward wind force, psf (kN/m<sup>2</sup>) as calculated in Section 1609.

$D$  = The dead weight of the glazing, psf (kN/m<sup>2</sup>) as determined in Section 2404.2 for glass, or by the weight of the plastic for plastic glazing.

$F_{gi}$  = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

$F_{go} = 0$ .

## SECTION 2406 SAFETY GLAZING

**2406.1 Human impact loads.** Individual glazed areas, including glass mirrors, in hazardous locations as defined in Section 2406.4 shall comply with Sections 2406.1.1 through 2406.1.4.

**Exception:** Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

**2406.1.1 Impact test.** Except as provided in Sections 2406.1.2 through 2406.1.4, all glazing shall pass the impact test requirements of Section 2406.2.

**2406.1.2 Plastic glazing.** Plastic glazing shall meet the weathering requirements of ANSI Z97.1.

**2406.1.3 Glass block.** Glass-block walls shall comply with Section 2101.2.5.

**2406.1.4 Louvered windows and jalousies.** Louvered windows and jalousies shall comply with Section 2403.5.

**2406.2 Impact test.** Where required by other sections of this code, glazing shall be tested in accordance with CPSC 16 CFR Part 1201. Glazing shall comply with the test criteria for Category II, unless otherwise indicated in Table 2406.2(1).

**Exception:** Glazing not in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers shall be permitted to be tested in accordance with ANSI Z97.1. Glazing shall comply with the test criteria for Class A, unless otherwise indicated in Table 2406.2(2).

**2406.3 Identification of safety glazing.** Except as indicated in Section 2406.3.1, each pane of safety glazing installed in hazardous locations shall be identified by a manufacturer's designation specifying who applied the designation, the manufacturer or installer and the safety glazing standard with which it complies, as well as the information specified in Section 2403.1. The designation shall be acid etched, sand

blasted, ceramic fired, laser etched, embossed or of a type that once applied, cannot be removed without being destroyed. A label as defined in Section 202 and meeting the requirements of this section shall be permitted in lieu of the manufacturer's designation.

### Exceptions:

1. For other than tempered glass, manufacturer's designations are not required, provided the building official approves the use of a certificate, affidavit or other evidence confirming compliance with this code.
2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation

**2406.3.1 Multi-pane assemblies.** Multi-pane glazed assemblies having individual panes not exceeding 1 square foot (0.09 m<sup>2</sup>) in exposed areas shall have at least one pane in the assembly marked as indicated in Section 2406.3. Other panes in the assembly shall be marked "CPSC 16 CFR Part 1201" or "ANSI Z97.1," as appropriate.

**2406.4 Hazardous locations.** The locations specified in Sections 2406.4.1 through 2406.4.7 shall be considered specific hazardous locations requiring safety glazing materials.

**2406.4.1 Glazing in doors.** Glazing in all fixed and operable panels of swinging, sliding, and bifold doors shall be considered a hazardous location.

### Exceptions:

1. Glazed openings of a size through which a 3-inch-diameter (76 mm) sphere is unable to pass.
2. Decorative glazing.
3. Glazing materials used as curved glazed panels in revolving doors.
4. Commercial refrigerated cabinet glazed doors.

TABLE 2406.2(1)  
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING CPSC 16 CFR PART 1201

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category class)	GLAZING IN DOORS (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.3 (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.2 (Category class)	DOORS AND ENCLOSURES REGULATED BY SECTION 2406.4.5 (Category class)	SLIDING GLASS DOORS PATIO TYPE (Category class)
9 square feet or less	I	I	No requirement	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

TABLE 2406.2(2)  
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING ANSI Z97.1

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZED PANELS REGULATED BY SECTION 2406.4.3 (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.2 (Category class)	DOORS AND ENCLOSURES REGULATED BY SECTION 2406.4.5 <sup>a</sup> (Category class)
9 square feet or less	No requirement	B	A
More than 9 square feet	A	A	A

For SI: square foot = 0.0929 m<sup>2</sup>.

a. Use is only permitted by the exception to Section 2406.2.

**2406.4.2 Glazing adjacent to doors.** Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface shall be considered a hazardous location.

**Exceptions:**

1. Decorative glazing.
2. Where there is an intervening wall or other permanent barrier between the door and glazing.
3. Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with Section 2406.4.3.
4. Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position in one- and two-family dwellings or within dwelling units in Group R-2.

**2406.4.3 Glazing in windows.** Glazing in an individual fixed or operable panel that meets all of the following conditions shall be considered a hazardous location:

1. The exposed area of an individual pane is greater than 9 square feet (0.84 m<sup>2</sup>);
2. The bottom edge of the glazing is less than 18 inches (457 mm) above the floor;
3. The top edge of the glazing is greater than 36 inches (914 mm) above the floor; and
4. One or more walking surface(s) are within 36 inches (914 mm), measured horizontally and in a straight line, of the plane of the glazing.

**Exceptions:**

1. Decorative glazing.
2. Where a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1½ inches (38 mm) in cross-sectional height.
3. Outboard panes in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet (7620 mm) or more above any grade, roof, walking surface or other horizontal or sloped (within 45 degrees of horizontal) (0.78 rad) surface adjacent to the glass exterior.

**2406.4.4 Glazing in guards and railings.** Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered a hazardous location.

**2406.4.5 Glazing and wet surfaces.** Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom

exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered a hazardous location. This shall apply to single glazing and all panes in multiple glazing.

**Exception:** Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the water's edge of a bathtub, hot tub, spa, whirlpool, or swimming pool.

**2406.4.6 Glazing adjacent to stairs and ramps.** Glazing where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs, and ramps shall be considered a hazardous location.

**Exceptions:**

1. The side of a stairway, landing or ramp that has a guard complying with the provisions of Sections 1013 and 1607.8, and the plane of the glass is greater than 18 inches (457 mm) from the railing.
2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.

**2406.4.7 Glazing adjacent to the bottom stair landing.** Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches (914 mm) above the landing and within 60 inches (1524 mm) horizontally of the bottom tread shall be considered a hazardous location.

**Exception:** Glazing that is protected by a guard complying with Sections 1013 and 1607.8 where the plane of the glass is greater than 18 inches (457 mm) from the guard.

**2406.5 Fire department access panels.** Fire department glass access panels shall be of tempered glass. For insulating glass units, all panes shall be tempered glass.

## SECTION 2407 GLASS IN HANDRAILS AND GUARDS

**2407.1 Materials.** Glass used as a handrail assembly or a guard section shall be constructed of either single fully tempered glass, laminated fully tempered glass or laminated heat-strengthened glass. Glazing in railing in-fill panels shall be of an approved safety glazing material that conforms to the provisions of Section 2406.1.1. For all glazing types, the minimum nominal thickness shall be ¼ inch (6.4 mm). Fully tempered glass and laminated glass shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.

**2407.1.1 Loads.** The panels and their support system shall be designed to withstand the loads specified in Section 1607.8. A safety factor of four shall be used.

**2407.1.2 Support.** Each handrail or guard section shall be supported by a minimum of three glass balusters or shall be otherwise supported to remain in place should one baluster panel fail. Glass balusters shall not be installed without an attached handrail or guard.

**Exception:** A top rail shall not be required where the glass balusters are laminated glass with two or more

glass plies of equal thickness and the same glass type when approved by the building official. The panels shall be designed to withstand the loads specified in Section 1607.8.

**2407.1.3 Parking garages.** Glazing materials shall not be installed in handrails or guards in parking garages except for pedestrian areas not exposed to impact from vehicles.

**2407.1.4 Glazing in wind-borne debris regions.** Glazing installed in in-fill panels or balusters in wind-borne debris regions shall comply with the following:

**2407.1.4.1 Ballusters and in-fill panels.** Glass installed in exterior railing in-fill panels or balusters shall be laminated glass complying with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.

**2407.1.4.2 Glass supporting top rail.** When the top rail is supported by glass, the assembly shall be tested according to the impact requirements of Section 1609.1.2. The top rail shall remain in place after impact.

## SECTION 2408 GLAZING IN ATHLETIC FACILITIES

**2408.1 General.** Glazing in athletic facilities and similar uses subject to impact loads, which forms whole or partial wall sections or which is used as a door or part of a door, shall comply with this section.

### 2408.2 Racquetball and squash courts.

**2408.2.1 Testing.** Test methods and loads for individual glazed areas in racquetball and squash courts subject to impact loads shall conform to those of CPSC 16 CFR Part 1201 or ANSI Z97.1 with impacts being applied at a height of 59 inches (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings and methods of assembly identical to those used in practice.

Glass walls shall comply with the following conditions:

1. A glass wall in a racquetball or squash court, or similar use subject to impact loads, shall remain intact following a test impact.
2. The deflection of such walls shall not be greater than  $1\frac{1}{2}$  inches (38 mm) at the point of impact for a drop height of 48 inches (1219 mm).

Glass doors shall comply with the following conditions:

1. Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
2. The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus  $\frac{1}{2}$  inch (12.7 mm) for a drop height of 48 inches (1219 mm).

**2408.3 Gymnasiums and basketball courts.** Glazing in multipurpose gymnasiums, basketball courts and similar ath-

letic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.

## SECTION 2409 GLASS IN ELEVATOR HOISTWAYS AND ELEVATOR CARS

**2409.1 Glass in elevator hoistway enclosures.** Glass in elevator hoistway enclosures and hoistway doors shall be laminated glass conforming to ANSI Z97.1 or CPSC 16 CFR Part 1201.

**2409.1.1 Fire-resistance-rated hoistways.** Glass installed in hoistways and hoistway doors where the hoistway is required to have a fire-resistance rating shall also comply with Section 716.

**2409.1.2 Glass hoistway doors.** The glass in glass hoistway doors shall be not less than 60 percent of the total visible door panel surface area as seen from the landing side.

**2409.2 Glass visions panels.** Glass in vision panels in elevator hoistway doors shall be permitted to be any transparent glazing material not less than  $\frac{1}{4}$  inches (0.64 mm) in thickness conforming to Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201. The area of any single vision panel shall not be less than 24 square inches (15 484 mm<sup>2</sup>) and the total area of one or more vision panels in any hoistway door shall be not more than 85 square inches (54 839 mm<sup>2</sup>).

### 2409.3 Glass in elevator cars.

**2409.3.1 Glass types.** Glass in elevator car enclosures, glass elevator car doors and glass used for lining walls and ceilings of elevator cars shall be laminated glass conforming to Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201.

**Exception:** Tempered glass shall be permitted to be used for lining walls and ceilings of elevator cars provided:

1. The glass is bonded to a nonpolymeric coating, sheeting or film backing having a physical integrity to hold the fragments when the glass breaks.
2. The glass is not subjected to further treatment such as sandblasting; etching; heat treatment or painting that could alter the original properties of the glass.
3. The glass is tested to the acceptance criteria for laminated glass as specified for Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201.

**2409.3.2 Surface area.** The glass in glass elevator car doors shall be not less than 60 percent of the total visible door panel surface area as seen from the car side of the doors.



## **SECTION 2410 [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] STRUCTURAL SEALANT GLAZING (SSG)**

**2410.1 General.** The requirements of this section address the use of structural sealant glazing (SSG). These requirements shall not be used for butt joint glazing, point supported glass, and glass fins.

Design, construction, testing, and inspection shall satisfy the requirements of this code except as modified in Sections 2410.1.1 through 2410.1.4.

**2410.1.1 Design.** Design of structural sealant glazing (SSG) shall satisfy the following requirements:

1. SSG shall be weather tight and serviceable under design story drifts associated with the design earthquake and no glass fallout shall occur at the drifts determined by ASCE 7, Section 13.5.9.
2. The sealant utilized in the insulated glass units used in SSG shall be designed in accordance with ASTM C 1249. The insulated glass unit design shall be in accordance with ASTM C 1249, Section 6.7.2.
3. Allowable stress for SSG shall not exceed 20 psi and shall have a minimum factor of safety of 5 as required by ASTM C 1401.
4. Design methodology shall address seismic movement in accordance with ASTM C 1401, Section 30.3.4.
5. SSG systems shall be supported for self-weight and lateral loading at each floor level of the building.
6. Unitized SSG framing shall be anchored to the building floor bearing plate by screws or bolts and shall not rely upon gravity or frictional forces for attachment.
7. Framing shall satisfy the out-of-plane deflection requirements of this code.

**2410.1.2 Testing and inspection.** Testing and inspection of structural sealant glazing (SSG) shall satisfy the following requirements:

- a. The seismic drift capability of structural sealant glazing shall be determined by tests in accordance with AAMA 501.6, AAMA 501.4 and ASCE 7, Section 13.5.9.2.
- b. The applicability of the specific AAMA 501.6 and AAMA 501.4 testing shall be subject to approval by the building official.
- c. The panel test specimens used in the AAMA 501.6 and AAMA 501.4 testing shall include all glass types (annealed, heat strengthened, laminated, tempered) and insulated glass units that comprise more than 5 percent of the total glass curtain wall area used in the building.
- d. AAMA 501.4 test specimen shall include the same materials, sections, connections, and attachment details to the test apparatus as used in the building.
- e. Serviceability tests of SSG test specimen shall be performed in accordance with AAMA 501.4 after seismic displacement tests to the design story drift.

f. The window wall system using structural sealant by different manufacturer/product category shall be qualified in accordance with AAMA 501.6 and AAMA 501.4 testing for the seismic drift required. Analysis as an alternative to testing is not acceptable for the purposes of satisfying the seismic drift requirements of the SSG system.

g. Where unitized SSG is used with horizontal stack joints at each floor level and split vertical mullions that can move independently, only a story height single unit need to be tested under AAMA 501.6. Where continuous horizontal bands of SSG are used in the building, either two or four sided, the aspect ratio (height-to-length) of the test specimen shall be less than 1.0, contain not less than two interior vertical joints and all joints (vertical in the case of two sided), including the perimeter of the glass, shall be glazed with SSG.

h. Where SSG continues around corners, the AAMA 501.4 test specimen shall include one corner panel to verify the kinematics of the corner condition under seismic drift.

i. Quality assurance and inspection requirements shall include formalized post-installation tests using the point load testing procedure in accordance with ASTM C 1392. The point load tests shall be done after the initial installation, then once every year for 3 years, not less than one test per elevation each time.

**Exception:** [DSA-SS, DSA-SS/CC] For two-sided SSG systems where the horizontal edges are mechanically attached to mullions, the yearly point load test for 3 years is not required.

j. Where the SSG is field assembled, hand pull tab tests in accordance with ASTM C 1401, Section X2.1, one test every 100 linear feet, but not less than one test for each building elevation view shall be required.

Existing AAMA 501.4 and 501.6 test results satisfying the requirements of this section shall be permitted, in lieu of project specific tests, when approved by the building official.

**2410.1.3 Monitoring.** Short- and long-term periodic performance monitoring shall be provided in accordance with ASTM C 1401, C 1392 and C 1394. Inspection frequencies recommended in ASTM C 1392 Section 5.1 shall be followed.

After every significant seismic event, where the ground shaking acceleration at the site exceeds 0.3g, or the acceleration at any monitored building level (if any) exceeds 0.8g, as measured by the seismic monitoring system in the building, the owner shall retain a structural engineer to make an inspection of the SSG system. The inspection shall include viewing the performance of the panel, structural sealant, glass, reviewing the strong motion records, and a visual examination of the overall performance for deterioration, offset or physical damage. A report for each

inspection, including conclusions on the continuing adequacy of the SSG system, shall be submitted to the enforcement agency.

**Exception:** [DSA-SS, DSA-SS/CC] The inspection requirements triggered by specific ground shaking acceleration or measured building acceleration is not required.

**2410.1.4 Construction documents.** Complete design of the SSG system for gravity, wind and seismic forces shall be subject to review by the enforcement agency. Construction documents shall show structural details of glass and curtain wall system including:

1. A design narrative explaining how the SSG is supported by the building and the mechanism used to accommodate seismic racking.
2. Type of SSG and whether field or shop built.
3. The means of supporting the glass during structural sealant curing time shall be shown in the construction documents.
4. Typical curtain wall panel elevation, plan view and sections.
5. Details of building corner joint to verify how the corner vertical mullion will move to accommodate the seismic drift.
6. Joints between panel and floors at top and bottom.
7. Joint between panels – including vertical and horizontal stack joints at intermediate and edge mullion.
8. Member sizes for curtain wall panels.
9. Glass pane sizes, thickness and type of glass.
10. Contact width of structural sealant and sealant materials for shop and field installation/reglazing.
11. Glass to aluminum joints (including primers, if any).
12. Maximum roof/floor dead and live load deflection of the roof/floor framing members supporting the exterior curtain wall system.
13. Required seismic separation or gap distance between the structural sealant glazing curtain wall and other adjacent cladding units.
14. Mitigation of galvanic reactions between the roof/floor slab anchors, steel screw connections of aluminum sections and the aluminum anchorage components, if any.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 25 – GYPSUM BOARD AND PLASTER

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X		X	X																
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter / Section																				
2501.2							X	X	X			X								
2503.2							X	X	X			X								
2504.2							X	X	X			X								
2504.2.1							X	X	X			X								
2505.3							X	X	X			X								
2507.3							X	X	X			X								
2508.5.6							X	X	X			X								

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.



## CHAPTER 25

# GYPSUM BOARD AND PLASTER

### SECTION 2501 GENERAL

#### 2501.1 Scope.

**2501.1.1 General.** Provisions of this chapter shall govern the materials, design, construction and quality of gypsum board, lath, gypsum plaster and cement plaster.

**2501.1.2 Performance.** Lathing, plastering and gypsum board construction shall be done in the manner and with the materials specified in this chapter, and when required for fire protection, shall also comply with the provisions of Chapter 7.

**2501.1.3 Other materials.** Other approved wall or ceiling coverings shall be permitted to be installed in accordance with the recommendations of the manufacturer and the conditions of approval.

**2501.2 Additional requirements.** *[DSA-SS, DSA-SS/CC and OSHPD 1 & 4]* Details of attachment for wall and ceiling coverings which are not provided for in these regulations shall be detailed in the approved construction documents.

### SECTION 2502 DEFINITIONS

**2502.1 Definitions.** The following terms are defined in Chapter 2:

CEMENT PLASTER.

EXTERIOR SURFACES.

GYPSUM BOARD.

GYPSUM PLASTER.

GYPSUM VENEER PLASTER.

INTERIOR SURFACES.

WEATHER-EXPOSED SURFACES.

WIRE BACKING.

### SECTION 2503 INSPECTION

**2503.1 Inspection.** Lath and gypsum board shall be inspected in accordance with Section 110.3.5, Chapter 1, Division II.

**2503.2 Additional requirements for inspection and testing.** *[DSA-S, DSA-SS/CC and OSHPD 1 & 4]*

1. Lath and gypsum board shall be inspected in accordance with Chapter 17A and the California Administrative Code.
2. No lath or gypsum wallboard or their attachments shall be covered or finished until it has been inspected and

*approved by the inspector of record and/or special inspector.*

3. The enforcement agency may require tests in accordance with Table 2506.2 to determine compliance with the provisions of these regulations.

4. The testing of gypsum and gypsum products shall conform with standards listed in Table 2506.2

### SECTION 2504 VERTICAL AND HORIZONTAL ASSEMBLIES

**2504.1 Scope.** The following requirements shall be met where construction involves gypsum board, lath and plaster in vertical and horizontal assemblies.

**2504.1.1 Wood framing.** Wood supports for lath or gypsum board, as well as wood stripping or furring, shall not be less than 2 inches (51 mm) nominal thickness in the least dimension.

**Exception:** The minimum nominal dimension of wood furring strips installed over solid backing shall not be less than 1 inch by 2 inches (25 mm by 51 mm).

**2504.1.2 Studless partitions.** The minimum thickness of vertically erected studless solid plaster partitions of  $\frac{3}{8}$ -inch (9.5 mm) and  $\frac{3}{4}$ -inch (19.1 mm) rib metal lath or  $\frac{1}{2}$ -inch thick (12.7 mm) long-length gypsum lath and gypsum board partitions shall be 2 inches (51 mm).

**2504.2 Additional requirements.** *[DSA-SS, DSA-SS/CC and OSHPD 1 & 4]* In addition to the requirements of this section, the horizontal and vertical assemblies of plaster or gypsum board shall be designed to resist the loads specified in this code. For suspended acoustical ceiling systems, see Section 2506. For gypsum construction see Section 2508.

**2504.2.1 Wood furring strips.** Wood furring strips for ceilings fastened to floor or ceiling joist shall be nailed at each bearing with two common wire nails, one of which shall be a slant nail and the other a face nail, or by one nail having spirally grooved or annular grooved shanks approved by the enforcement agency for this purpose. All stripping nails shall penetrate not less than  $1\frac{3}{4}$  inches (44.5 mm) into the member receiving the point. Holes in stripping at joints shall be subdrilled to prevent splitting.

Where common wire nails are used to support horizontal wood stripping for plaster ceilings, such stripping shall be wire tied to the joists 4 feet (1219 mm) on center with two strands of No. 18 W&M gage galvanized annealed wire to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist, and the ends of the wire secured together with three twists of the wire.

## SECTION 2505 SHEAR WALL CONSTRUCTION

**2505.1 Resistance to shear (wood framing).** Wood-framed shear walls sheathed with gypsum board, lath and plaster shall be designed and constructed in accordance with Section 2306.3 and are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7.

**2505.2 Resistance to shear (steel framing).** Cold-formed steel-framed shear walls sheathed with gypsum board and constructed in accordance with the materials and provisions of Section 2211.6 are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7.

**2505.3 [DSA-SS & DSA-SS/CC and OSHPD 1 & 4] Section 2505.1 and 2505.2 are not permitted.**

## SECTION 2506 GYPSUM BOARD MATERIALS

**2506.1 General.** Gypsum board materials and accessories shall be identified by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored to protect such materials from the weather.

**2506.2 Standards.** Gypsum board materials shall conform to the appropriate standards listed in Table 2506.2 and Chapter 35 and, where required for fire protection, shall conform to the provisions of Chapter 7.

**2506.2.1 Other materials.** Metal suspension systems for acoustical and lay-in panel ceilings shall conform with ASTM C 635 listed in Chapter 35 and Section 13.5.6 of ASCE 7 for installation in high seismic areas.

**TABLE 2506.2  
GYPSUM BOARD MATERIALS AND ACCESSORIES**

MATERIAL	STANDARD
Accessories for gypsum board	ASTM C 1047
Adhesives for fastening gypsum wallboard	ASTM C 557
Elastomeric joint sealants	ASTM C 920
Fiber-reinforced gypsum panels	ASTM C 1278
Glass mat gypsum backing panel	ASTM C 1178
Glass mat gypsum panel	ASTM C 1658
Glass mat gypsum substrate	ASTM C 1177
Joint reinforcing tape and compound	ASTM C 474; C 475
Nails FOR gypsum boards	ASTM C 514, F 547, F 1667
Steel screws	ASTM C 954; C 1002
Steel studs, load-bearing	ASTM C 955
Steel studs, nonload-bearing	ASTM C 645
Standard specification for gypsum board	ASTM C 1396
Testing gypsum and gypsum products	ASTM C 22; C 472; C 473

## SECTION 2507 LATHING AND PLASTERING

**2507.1 General.** Lathing and plastering materials and accessories shall be marked by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored in such a manner to protect them from the weather.

**2507.2 Standards.** Lathing and plastering materials shall conform to the standards listed in Table 2507.2 and Chapter 35 and, where required for fire protection, shall also conform to the provisions of Chapter 7.

**TABLE 2507.2  
LATH, PLASTERING MATERIALS AND ACCESSORIES**

MATERIAL	STANDARD
Accessories for gypsum veneer base	ASTM C 1047
Blended cement	ASTM C 595
Exterior plaster bonding compounds	ASTM C 932
Gypsum casting and molding plaster	ASTM C 59
Gypsum Keene's cement	ASTM C 61
Gypsum plaster	ASTM C 28
Gypsum veneer plaster	ASTM C 587
Interior bonding compounds, gypsum	ASTM C 631
Lime plasters	ASTM C 5; C 206
Masonry cement	ASTM C 91
Metal lath	ASTM C 847
Plaster aggregates Sand Perlite Vermiculite	ASTM C 35; C 897 ASTM C 35 ASTM C 35
Plastic cement	ASTM C 1328
Portland cement	ASTM C 150
Steel screws	ASTM C 1002; C 954
Steel studs and track	ASTM C 645; C 955
Welded wire lath	ASTM C 933
Woven wire plaster base	ASTM C 1032

**2507.3 Lath attachment to horizontal wood supports. [DSA-SS & DSA-SS/CC and OSHPD 1 & 4]** Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.

1. Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches (76 mm) back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist and the

ends of the wire secured together with three twists of the wire.

2. Secure lath to each support with  $\frac{1}{2}$ -inch-wide (12.7 mm), 1  $\frac{1}{2}$ -inch-long (38mm) No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches (76 mm) from edge of each sheet. Such staples may be placed over ribs of  $\frac{3}{8}$ -inch (9.5 mm) rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.

## SECTION 2508 GYPSUM CONSTRUCTION

**2508.1 General.** Gypsum board and gypsum plaster construction shall be of the materials listed in Tables 2506.2 and 2507.2. These materials shall be assembled and installed in compliance with the appropriate standards listed in Tables 2508.1 and 2511.1.1, and Chapter 35.

**TABLE 2508.1  
INSTALLATION OF GYPSUM CONSTRUCTION**

MATERIAL	STANDARD
Gypsum board	GA-216; ASTM C 840
Gypsum sheathing	ASTM C 1280
Gypsum veneer base	ASTM C 844
Interior lathing and furring	ASTM C 841
Steel framing for gypsum boards	ASTM C 754; C 1007

**2508.2 Limitations.** Gypsum wallboard or gypsum plaster shall not be used in any exterior surface where such gypsum construction will be exposed directly to the weather. Gypsum wallboard shall not be used where there will be direct exposure to water or continuous high humidity conditions. Gypsum sheathing shall be installed on exterior surfaces in accordance with ASTM C 1280.

**2508.2.1 Weather protection.** Gypsum wallboard, gypsum lath or gypsum plaster shall not be installed until weather protection for the installation is provided.

**2508.3 Single-ply application.** Edges and ends of gypsum board shall occur on the framing members, except those edges and ends that are perpendicular to the framing mem-

bers. Edges and ends of gypsum board shall be in moderate contact except in concealed spaces where fire-resistance-rated construction, shear resistance or diaphragm action is not required.

**2508.3.1 Floating angles.** Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line are permitted to be omitted except on shear resisting elements or fire-resistance-rated assemblies. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.

**2508.4 Joint treatment.** Gypsum board fire-resistance-rated assemblies shall have joints and fasteners treated.

**Exception:** Joint and fastener treatment need not be provided where any of the following conditions occur:

1. Where the gypsum board is to receive a decorative finish such as wood paneling, battens, acoustical finishes or any similar application that would be equivalent to joint treatment.
2. On single-layer systems where joints occur over wood framing members.
3. Square edge or tongue-and-groove edge gypsum board (V-edge), gypsum backing board or gypsum sheathing.
4. On multilayer systems where the joints of adjacent layers are offset from one to another.
5. Assemblies tested without joint treatment.

**2508.5 Horizontal gypsum board diaphragm ceilings.** Gypsum board shall be permitted to be used on wood joists to create a horizontal diaphragm ceiling in accordance with Table 2508.5.

**2508.5.1 Diaphragm proportions.** The maximum allowable diaphragm proportions shall be  $1\frac{1}{2}$ :1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted.

**2508.5.2 Installation.** Gypsum board used in a horizontal diaphragm ceiling shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of gypsum board shall not occur on the same joist.

**TABLE 2508.5  
SHEAR CAPACITY FOR HORIZONTAL WOOD FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES**

MATERIAL	THICKNESS OF MATERIAL (MINIMUM) (inches)	SPACING OF FRAMING MEMBERS (MAXIMUM) (inches)	SHEAR VALUE <sup>a, b</sup> (plf of ceiling)	MINIMUM FASTENER SIZE
Gypsum board	$\frac{1}{2}$	16 o.c.	90	5d cooler or wallboard nail; 1 $\frac{5}{8}$ -inch long; 0.086-inch shank; $\frac{15}{64}$ -inch head <sup>c</sup>
Gypsum board	$\frac{1}{2}$	24 o.c.	70	5d cooler or wallboard nail; 1 $\frac{5}{8}$ -inch long; 0.086-inch shank; $\frac{15}{64}$ -inch head <sup>c</sup>

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.59 N/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term loading due to wind or seismic loading. Values shall be reduced 25 percent for normal loading.

b. Values shall be reduced 50 percent in Seismic Design Categories D, E and F.

c. 1 $\frac{1}{4}$ -inch, No. 6 Type S or W screws are permitted to be substituted for the listed nails.



**2508.5.3 Blocking of perimeter edges.** All perimeter edges shall be blocked using a wood member not less than 2-inch by 6-inch (51 mm by 159 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board.

**2508.5.4 Fasteners.** Fasteners used for the attachment of gypsum board to a horizontal diaphragm ceiling shall be as defined in Table 2508.5. Fasteners shall be spaced not more than 7 inches (178 mm) on center (o.c.) at all supports, including perimeter blocking, and not more than  $\frac{3}{8}$  inch (9.5 mm) from the edges and ends of the gypsum board.

**2508.5.5 Lateral force restrictions.** Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction.

**2508.5.6 Diaphragm ceiling connection to partitions.** *[DSA-SS & DSA-SS/CC and OSHPD 1 & 4] Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by partitions. Connection of diaphragm ceiling to the vertical lateral force resisting elements shall be designed and detailed to transfer lateral forces.*

## SECTION 2509 GYPSUM BOARD IN SHOWERS AND WATER CLOSETS

**2509.1 Wet areas.** Showers and public toilet walls shall conform to Section 1210.2.

**2509.2 Base for tile.** Glass mat water-resistant gypsum backing panels, discrete nonasbestos fiber-cement interior substrate sheets or nonasbestos fiber-mat reinforced cementitious backer units in compliance with ASTM C 1178, C 1288 or C 1325 and installed in accordance with manufacturer recommendations shall be used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas. Water-resistant gypsum backing board shall be used as a base for tile in water closet compartment walls when installed in accordance with GA-216 or ASTM C 840 and manufacturer recommendations. Regular gypsum wallboard is permitted under tile or wall panels in other wall and ceiling areas when installed in accordance with GA-216 or ASTM C 840.

**2509.3 Limitations.** Water-resistant gypsum backing board shall not be used in the following locations:

1. Over a vapor retarder in shower or bathtub compartments.
2. Where there will be direct exposure to water or in areas subject to continuous high humidity.
3. On ceilings where frame spacing exceeds 12 inches (305 mm) o.c. for  $\frac{1}{2}$ -inch thick (12.7 mm) water-resistant gypsum backing board and more than 16 inches (406 mm) o.c. for  $\frac{5}{8}$ -inch thick (15.9 mm) water-resistant gypsum backing board.

## SECTION 2510 LATHING AND FURRING FOR CEMENT PLASTER (STUCCO)

**2510.1 General.** Exterior and interior cement plaster and lathing shall be done with the appropriate materials listed in Table 2507.2 and Chapter 35.

**2510.2 Weather protection.** Materials shall be stored in such a manner as to protect such materials from the weather.

**2510.3 Installation.** Installation of these materials shall be in compliance with ASTM C 926 and ASTM C 1063.

**2510.4 Corrosion resistance.** Metal lath and lath attachments shall be of corrosion-resistant material.

**2510.5 Backing.** Backing or a lath shall provide sufficient rigidity to permit plaster applications.

**2510.5.1 Support of lath.** Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

**2510.5.2 Use of gypsum backing board.**

**2510.5.2.1 Use of gypsum board as a backing board.**

Gypsum lath or gypsum wallboard shall not be used as a backing for cement plaster.

**Exception:** Gypsum lath or gypsum wallboard is permitted, with a water-resistive barrier, as a backing for self-furred metal lath or self-furred wire fabric lath and cement plaster where either of the following conditions occur:

1. On horizontal supports of ceilings or roof soffits.
2. On interior walls.

**2510.5.2.2 Use of gypsum sheathing backing.** Gypsum sheathing is permitted as a backing for metal or wire fabric lath and cement plaster on walls. A water-resistive barrier shall be provided in accordance with Section 2510.6.

**2510.5.3 Backing not required.** Wire backing is not required under expanded metal lath or paperbacked wire fabric lath.

**2510.6 Water-resistive barriers.** Water-resistive barriers shall be installed as required in Section 1404.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section 1405.4) intended to drain to the water-resistive barrier is directed between the layers.

**Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or drainage space.

**2510.7 Preparation of masonry and concrete.** Surfaces shall be clean, free from efflorescence, sufficiently damp and

rough for proper bond. If the surface is insufficiently rough, approved bonding agents or a Portland cement dash bond coat mixed in proportions of not more than two parts volume of sand to one part volume of Portland cement or plastic cement shall be applied. The dash bond coat shall be left undisturbed and shall be moist cured not less than 24 hours.

## SECTION 2511 INTERIOR PLASTER

**2511.1 General.** Plastering gypsum plaster or cement plaster shall not be less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over other bases permitted by this chapter.

**Exception:** Gypsum veneer plaster and cement plaster specifically designed and approved for one-coat applications.

**2511.1.1 Installation.** Installation of lathing and plaster materials shall conform with Table 2511.1.1 and Section 2507.

**TABLE 2511.1.1  
INSTALLATION OF PLASTER CONSTRUCTION**

MATERIAL	STANDARD
Cement plaster	ASTM C 926
Gypsum plaster	ASTM C 842
Gypsum veneer plaster	ASTM C 843
Interior lathing and furring (gypsum plaster)	ASTM C 841
Lathing and furring (cement plaster)	ASTM C 1063
Steel framing	ASTM C 754; C 1007

**2511.2 Limitations.** Plaster shall not be applied directly to fiber insulation board. Cement plaster shall not be applied directly to gypsum lath or gypsum plaster except as specified in Sections 2510.5.1 and 2510.5.2.

**2511.3 Grounds.** Where installed, grounds shall ensure the minimum thickness of plaster as set forth in ASTM C 842 and ASTM C 926. Plaster thickness shall be measured from the face of lath and other bases.

**2511.4 Interior masonry or concrete.** Condition of surfaces shall be as specified in Section 2510.7. Approved specially prepared gypsum plaster designed for application to concrete surfaces or approved acoustical plaster is permitted. The total thickness of base coat plaster applied to concrete ceilings shall be as set forth in ASTM C 842 or ASTM C 926. Should ceiling surfaces require more than the maximum thickness permitted in ASTM C 842 or ASTM C 926, metal lath or wire fabric lath shall be installed on such surfaces before plastering.

**2511.5 Wet areas.** Showers and public toilet walls shall conform to Sections 1210.2 and 1210.3. When wood frame walls and partitions are covered on the interior with cement plaster or tile of similar material and are subject to water splash, the framing shall be protected with an approved moisture barrier.

## SECTION 2512 EXTERIOR PLASTER

**2512.1 General.** Plastering with cement plaster shall be not less than three coats when applied over metal lath or wire fabric lath or gypsum board backing as specified in Section 2510.5 and shall be not less than two coats when applied over masonry or concrete. If the plaster surface is to be completely covered by veneer or other facing material, or is completely concealed by another wall, plaster application need only be two coats, provided the total thickness is as set forth in ASTM C 926.

**2512.1.1 On-grade floor slab.** On wood framed or steel stud construction with an on-grade concrete floor slab system, exterior plaster shall be applied in such a manner as to cover, but not to extend below, the lath and paper. The application of lath, paper and flashing or drip screeds shall comply with ASTM C 1063.

**2512.1.2 Weep screeds.** A minimum 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed with a minimum vertical attachment flange of 3½ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C 926. The weep screed shall be placed a minimum of 4 inches (102 mm) above the earth or 2 inches (51 mm) above paved areas and be of a type that will allow trapped water to drain to the exterior of the building. The water-resistive barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

**2512.2 Plasticity agents.** Only approved plasticity agents and approved amounts thereof shall be added to Portland cement or blended cements. When plastic cement or masonry cement is used, no additional lime or plasticizers shall be added. Hydrated lime or the equivalent amount of lime putty used as a plasticizer is permitted to be added to cement plaster or cement and lime plaster in an amount not to exceed that set forth in ASTM C 926.

**2512.3 Limitations.** Gypsum plaster shall not be used on exterior surfaces.

**2512.4 Cement plaster.** Plaster coats shall be protected from freezing for a period of not less than 24 hours after set has occurred. Plaster shall be applied when the ambient temperature is higher than 40°F (4°C), unless provisions are made to keep cement plaster work above 40°F (4°C) during application and 48 hours thereafter.

**2512.5 Second-coat application.** The second coat shall be brought out to proper thickness, rodded and floated sufficiently rough to provide adequate bond for the finish coat. The second coat shall have no variation greater than ¼ inch (6.4 mm) in any direction under a 5-foot (1524 mm) straight edge.

**2512.6 Curing and interval.** First and second coats of cement plaster shall be applied and moist cured as set forth in ASTM C 926 and Table 2512.6.

**TABLE 2512.6  
CEMENT PLASTERS**

COAT	MINIMUM PERIOD MOIST CURING	MINIMUM INTERVAL BETWEEN COATS
First	48 hours <sup>a</sup>	48 hours <sup>b</sup>
Second	48 hours	7 days <sup>c</sup>
Finish	—	Note c

a. The first two coats shall be as required for the first coats of exterior plaster, except that the moist-curing time period between the first and second coats shall not be less than 24 hours. Moist curing shall not be required where job and weather conditions are favorable to the retention of moisture in the cement plaster for the required time period.

b. Twenty-four-hour minimum interval between coats of interior cement plaster. For alternative method of application, see Section 2512.8.

c. Finish coat plaster is permitted to be applied to interior cement plaster base coats after a 48-hour period.

**2512.7 Application to solid backings.** Where applied over gypsum backing as specified in Section 2510.5 or directly to unit masonry surfaces, the second coat is permitted to be applied as soon as the first coat has attained sufficient hardness.

**2512.8 Alternate method of application.** The second coat is permitted to be applied as soon as the first coat has attained sufficient rigidity to receive the second coat.

**2512.8.1 Admixtures.** When using this method of application, calcium aluminate cement up to 15 percent of the weight of the Portland cement is permitted to be added to the mix.

**2512.8.2 Curing.** Curing of the first coat is permitted to be omitted and the second coat shall be cured as set forth in ASTM C 926 and Table 2512.6.

**2512.9 Finish coats.** Cement plaster finish coats shall be applied over base coats that have been in place for the time periods set forth in ASTM C 926. The third or finish coat shall be applied with sufficient material and pressure to bond and to cover the brown coat and shall be of sufficient thickness to conceal the brown coat.

## **SECTION 2513 EXPOSED AGGREGATE PLASTER**

**2513.1 General.** Exposed natural or integrally colored aggregate is permitted to be partially embedded in a natural or colored bedding coat of cement plaster or gypsum plaster, subject to the provisions of this section.

**2513.2 Aggregate.** The aggregate shall be applied manually or mechanically and shall consist of marble chips, pebbles or similar durable, moderately hard (three or more on the Mohs hardness scale), nonreactive materials.

**2513.3 Bedding coat proportions.** The bedding coat for interior or exterior surfaces shall be composed of one part Portland cement and one part Type S lime; or one part blended cement and one part Type S lime; or masonry cement; or plastic cement, and a maximum of three parts of

graded white or natural sand by volume. The bedding coat for interior surfaces shall be composed of 100 pounds (45.4 kg) of neat gypsum plaster and a maximum of 200 pounds (90.8 kg) of graded white sand. A factory-prepared bedding coat for interior or exterior use is permitted. The bedding coat for exterior surfaces shall have a minimum compressive strength of 1,000 pounds per square inch (psi) (6895 kPa).

**2513.4 Application.** The bedding coat is permitted to be applied directly over the first (scratch) coat of plaster, provided the ultimate overall thickness is a minimum of  $\frac{7}{8}$  inch (22 mm), including lath. Over concrete or masonry surfaces, the overall thickness shall be a minimum of  $\frac{1}{2}$  inch (12.7 mm).

**2513.5 Bases.** Exposed aggregate plaster is permitted to be applied over concrete, masonry, cement plaster base coats or gypsum plaster base coats installed in accordance with Section 2511 or 2512.

**2513.6 Preparation of masonry and concrete.** Masonry and concrete surfaces shall be prepared in accordance with the provisions of Section 2510.7.

**2513.7 Curing of base coats.** Cement plaster base coats shall be cured in accordance with ASTM C 926. Cement plaster bedding coats shall retain sufficient moisture for hydration (hardening) for 24 hours minimum or, where necessary, shall be kept damp for 24 hours by light water spraying.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 26 – PLASTIC

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X	X	X	X			X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter / Section																				

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 26

# PLASTIC

### SECTION 2601 GENERAL

**2601.1 Scope.** These provisions shall govern the materials, design, application, construction and installation of foam plastic, foam plastic insulation, plastic veneer, interior plastic finish and trim and light-transmitting plastics. See Chapter 14 for requirements for exterior wall finish and trim.

### SECTION 2602 DEFINITIONS

**2602.1 Definitions.** The following terms are defined in Chapter 2:

**FIBER-REINFORCED POLYMER.**

**FOAM PLASTIC INSULATION.**

**LIGHT-DIFFUSING SYSTEM.**

**LIGHT-TRANSMITTING PLASTIC ROOF PANELS.**

**LIGHT-TRANSMITTING PLASTIC WALL PANELS.**

**PLASTIC, APPROVED.**

**PLASTIC GLAZING.**

**THERMOPLASTIC MATERIAL.**

**THERMOSETTING MATERIAL.**

### SECTION 2603 FOAM PLASTIC INSULATION

**2603.1 General.** The provisions of this section shall govern the requirements and uses of foam plastic insulation in buildings and structures.

**2603.2 Labeling and identification.** Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

**2603.3 Surface-burning characteristics.** Unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread and smoke-developed indexes.

#### Exceptions:

1. Smoke-developed index for interior trim as provided for in Section 2604.2.
2. In cold storage buildings, ice plants, food plants, food processing rooms and similar areas, foam plas-

tic insulation where tested in a thickness of 4 inches (102 mm) shall be permitted in a thickness up to 10 inches (254 mm) where the building is equipped throughout with an automatic fire sprinkler system in accordance with Section 903.3.1.1. The approved automatic sprinkler system shall be provided in both the room and that part of the building in which the room is located.

3. Foam plastic insulation that is a part of a Class A, B or C roof-covering assembly provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256. The smoke-developed index shall not be limited for roof applications.
4. Foam plastic insulation greater than 4 inches (102 mm) in thickness shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is approved in accordance with Section 2603.10 using the thickness and density intended for use.
5. Flame spread and smoke-developed indexes for foam plastic interior signs in covered and open mall buildings provided the signs comply with Section 402.6.4.

**2603.4 Thermal barrier.** Except as provided for in Sections 2603.4.1 and 2603.10, foam plastic shall be separated from the interior of a building by an approved thermal barrier of ½-inch (12.7 mm) gypsum wallboard or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275. Combustible concealed spaces shall comply with Section 718.

**2603.4.1 Thermal barrier not required.** The thermal barrier specified in Section 2603.4 is not required under the conditions set forth in Sections 2603.4.1.1 through 2603.4.1.14.

**2603.4.1.1 Masonry or concrete construction.** A thermal barrier is not required for foam plastic installed in a masonry or concrete wall, floor or roof system where the foam plastic insulation is covered on each face by a minimum of 1-inch (25 mm) thickness of masonry or concrete.

**2603.4.1.2 Cooler and freezer walls.** Foam plastic installed in a maximum thickness of 10 inches (254 mm) in cooler and freezer walls shall:

1. Have a flame spread index of 25 or less and a smoke-developed index of not more than 450, where tested in a minimum 4-inch (102 mm) thickness.
2. Have flash ignition and self-ignition temperatures of not less than 600°F and 800°F (316°C and 427°C), respectively.

3. Have a covering of not less than 0.032-inch (0.8 mm) aluminum or corrosion-resistant steel having a base metal thickness not less than 0.0160 inch (0.4 mm) at any point.
4. Be protected by an automatic sprinkler system in accordance with Section 903.3.1.1. Where the cooler or freezer is within a building, both the cooler or freezer and that part of the building in which it is located shall be sprinklered.

**2603.4.1.3 Walk-in coolers.** In nonsprinklered buildings, foam plastic having a thickness that does not exceed 4 inches (102 mm) and a maximum flame spread index of 75 is permitted in walk-in coolers or freezer units where the aggregate floor area does not exceed 400 square feet (37 m<sup>2</sup>) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). A thickness of up to 10 inches (254 mm) is permitted where protected by a thermal barrier.

**2603.4.1.4 Exterior walls-one-story buildings.** For one-story buildings, foam plastic having a flame spread index of 25 or less, and a smoke-developed index of not more than 450, shall be permitted without thermal barriers in or on exterior walls in a thickness not more than 4 inches (102 mm) where the foam plastic is covered by a thickness of not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm) and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**2603.4.1.5 Roofing.** Foam plastic insulation under a roof assembly or roof covering that is installed in accordance with the code and the manufacturer's instructions shall be separated from the interior of the building by wood structural panel sheathing not less than 0.47 inch (11.9 mm) in thickness bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints or other approved type of edge support, or an equivalent material. A thermal barrier is not required for foam plastic insulation that is a part of a Class A, B or C roof-covering assembly, provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256.

**2603.4.1.6 Attics and crawl spaces.** Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition by 1½-inch-thick (38 mm) mineral fiber insulation; ¼-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; ⅜-inch (9.5 mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4 mm) or other approved material installed in such a manner that the foam plastic insulation is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

**2603.4.1.7 Doors not required to have a fire protection rating.** Where pivoted or side-hinged doors are

permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

**2603.4.1.8 Exterior doors in buildings of Group R-2 or R-3.** In occupancies classified as Group R-2 or R-3, foam-filled exterior entrance doors to individual dwelling units that do not require a fire-resistance rating shall be faced with wood or other approved materials.

**2603.4.1.9 Garage doors.** Where garage doors are permitted without a fire-resistance rating and foam plastic is used as a core material, the door facing shall be metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or 0.010-inch (0.25 mm) steel or the facing shall be minimum 0.125-inch-thick (3.2 mm) wood. Garage doors having facings other than those described above shall be tested in accordance with, and meet the acceptance criteria of, DASMA 107.

**Exception:** Garage doors using foam plastic insulation complying with Section 2603.3 in detached and attached garages associated with one- and two-family dwellings need not be provided with a thermal barrier.

**2603.4.1.10 Siding backer board.** Foam plastic insulation of not more than 2,000 British thermal units per square feet (Btu/sq. ft.) (22.7 mJ/m<sup>2</sup>) as determined by NFPA 259 shall be permitted as a siding backer board with a maximum thickness of ½ inch (12.7 mm), provided it is separated from the interior of the building by not less than 2 inches (51 mm) of mineral fiber insulation or equivalent or where applied as insulation with residing over existing wall construction.

**2603.4.1.11 Interior trim.** Foam plastic used as interior trim in accordance with Section 2604 shall be permitted without a thermal barrier.

**2603.4.1.12 Interior signs.** Foam plastic used for interior signs in covered mall buildings in accordance with Section 402.6.4 shall be permitted without a thermal barrier. Foam plastic signs that are not affixed to interior building surfaces shall comply with Chapter 8 of the *California Fire Code*.

**2603.4.1.13 Type V construction.** Foam plastic spray applied to a sill plate and header of Type V construction is subject to all of the following:

1. The maximum thickness of the foam plastic shall be 3¼ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m<sup>3</sup>).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723.

**2603.4.1.14 Floors.** The thermal barrier specified in Section 2603.4 is not required to be installed on the walking surface of a structural floor system that contains foam plastic insulation when the foam plastic is covered by a minimum nominal ½-inch-thick (12.7 mm) wood structural panel or approved equivalent. The thermal barrier specified in Section 2603.4 is required on the underside of the structural floor system that contains foam plastic insulation when the underside of the structural floor system is exposed to the interior of the building.

**Exception:** Foam plastic used as part of an interior floor finish.

**2603.5 Exterior walls of buildings of any height.** Exterior walls of buildings of Type I, II, III or IV construction of any height shall comply with Sections 2603.5.1 through 2603.5.7. Exterior walls of cold storage buildings required to be constructed of noncombustible materials, where the building is more than one story in height, shall also comply with the provisions of Sections 2603.5.1 through 2603.5.7. Exterior walls of buildings of Type V construction shall comply with Sections 2603.2, 2603.3 and 2603.4.

**2603.5.1 Fire-resistance-rated walls.** Where the wall is required to have a fire-resistance rating, data based on tests conducted in accordance with ASTM E 119 or UL 263 shall be provided to substantiate that the fire-resistance rating is maintained.

**2603.5.2 Thermal barrier.** Any foam plastic insulation shall be separated from the building interior by a thermal barrier meeting the provisions of Section 2603.4, unless special approval is obtained on the basis of Section 2603.10.

**Exception:** One-story buildings complying with Section 2603.4.1.4.

**2603.5.3 Potential heat.** The potential heat of foam plastic insulation in any portion of the wall or panel shall not exceed the potential heat expressed in Btu per square foot ( $\text{MJ/m}^2$ ) of the foam plastic insulation contained in the wall assembly tested in accordance with Section 2603.5.5. The potential heat of the foam plastic insulation shall be determined by tests conducted in accordance with NFPA 259 and the results shall be expressed in Btu per square foot ( $\text{MJ/m}^2$ ).

**Exception:** One-story buildings complying with Section 2603.4.1.4.

**2603.5.4 Flame spread and smoke-developed indexes.** Foam plastic insulation, exterior coatings and facings shall be tested separately in the thickness intended for use, but not to exceed 4 inches (102 mm), and shall each have a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723.

**Exception:** Prefabricated or factory-manufactured panels having minimum 0.020-inch (0.51 mm) aluminum facings and a total thickness of ¼ inch (6.4 mm) or less are permitted to be tested as an assembly where the

foam plastic core is not exposed in the course of construction.

**2603.5.5 Vertical and lateral fire propagation.** The exterior wall assembly shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

**Exception:** One-story buildings complying with Section 2603.4.1.4.

**2603.5.6 Label required.** The edge or face of each piece, package or container of foam plastic insulation shall bear the label of an approved agency. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or materials' performance characteristics and approved agency's identification.

**2603.5.7 Ignition.** Exterior walls shall not exhibit sustained flaming where tested in accordance with NFPA 268. Where a material is intended to be installed in more than one thickness, tests of the minimum and maximum thickness intended for use shall be performed.

**Exception:** Assemblies protected on the outside with one of the following:

1. A thermal barrier complying with Section 2603.4.
2. A minimum 1 inch (25 mm) thickness of concrete or masonry.
3. Glass-fiber-reinforced concrete panels of a minimum thickness of ⅜ inch (9.5 mm).
4. Metal-faced panels having minimum 0.019-inch-thick (0.48 mm) aluminum or 0.016-inch-thick (0.41 mm) corrosion-resistant steel outer facings.
5. A minimum ⅞-inch (22.2 mm) thickness of stucco complying with Section 2510.

**2603.6 Roofing.** Foam plastic insulation meeting the requirements of Sections 2603.2, 2603.3 and 2603.4 shall be permitted as part of a roof-covering assembly, provided the assembly with the foam plastic insulation is a Class A, B or C roofing assembly where tested in accordance with ASTM E 108 or UL 790.

**2603.7 Interior finish in plenums.** Foam plastic insulation used as interior wall or ceiling finish in plenums shall comply with one or more of the following:

1. The foam plastic insulation shall be separated from the plenum by a thermal barrier complying with Section 2603.4 and shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723 at the thickness and density intended for use.
2. The foam plastic insulation shall exhibit a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E 84 or UL 723 at the thickness and density intended for use and shall meet the acceptance criteria of Section 803.1.2 when tested in accordance with NFPA 286.
3. The foam plastic insulation shall be covered by corrosion-resistant steel having a base metal thickness of not



less than 0.0160 inch (0.4 mm) and shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723 at the thickness and density intended for use.

**2603.8 Interior trim in plenums.** Foam plastic insulation used as interior trim in plenums shall comply with the requirements of Section 2603.7.

**2603.9 Protection against termites.** In areas where the probability of termite infestation is very heavy in accordance with Figure 2603.9, extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be at least 6 inches (152 mm).

**Exceptions:**

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or preservative-treated wood.
2. An approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

**2603.10 Special approval.** Foam plastic shall not be required to comply with the requirements of Sections 2603.4 through 2603.8 where specifically approved based on large-scale tests such as, but not limited to, NFPA 286 (with the acceptance

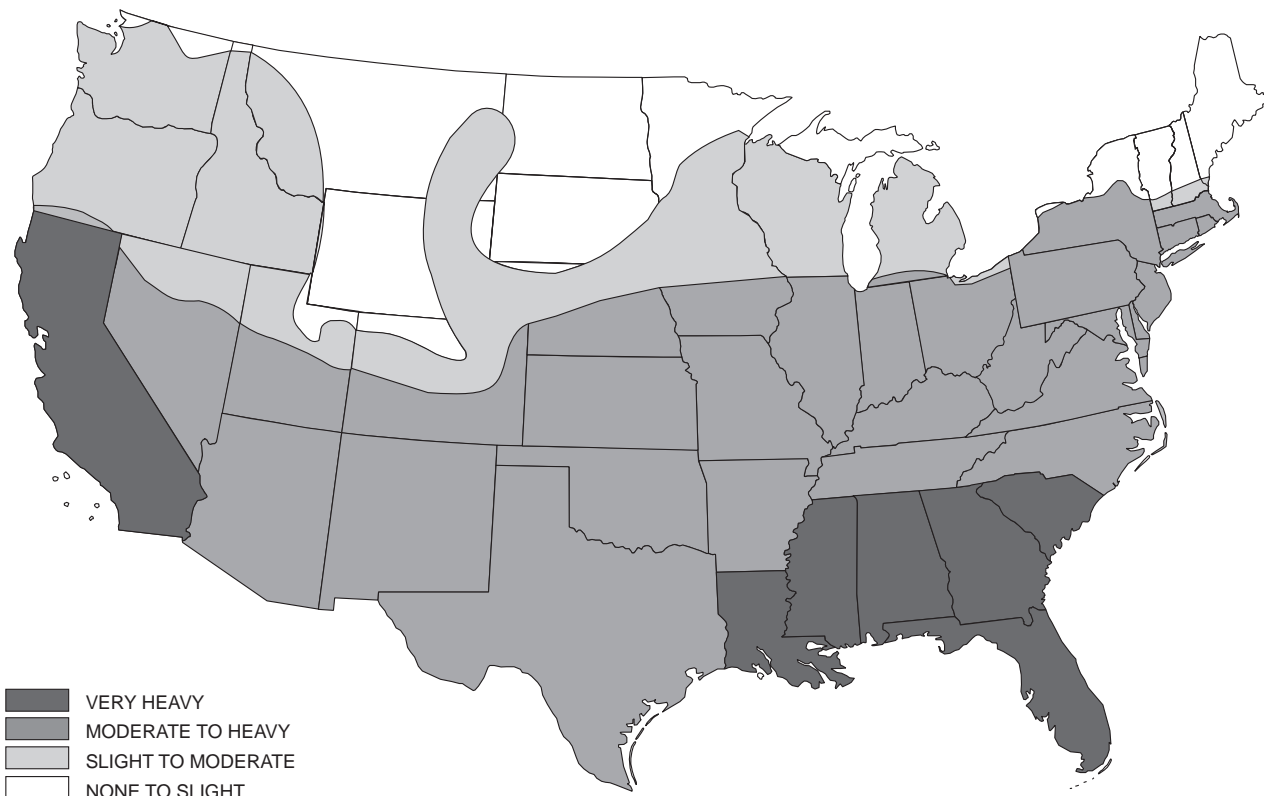
criteria of Section 803.2), FM 4880, UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall also conform to the flame spread and smoke-developed requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

**2603.10.1 Exterior walls.** Testing based on Section 2603.10 shall not be used to eliminate any component of the construction of an exterior wall assembly when that component was included in the construction that has met the requirements of Section 2603.5.5.

**SECTION 2604  
INTERIOR FINISH AND TRIM**

**2604.1 General.** Plastic materials installed as interior finish or trim shall comply with Chapter 8. Foam plastics shall only be installed as interior finish where approved in accordance with the special provisions of Section 2603.10. Foam plastics that are used as interior finish shall also meet the flame-spread index requirements for interior finish in accordance with Chapter 8. Foam plastics installed as interior trim shall comply with Section 2604.2.

**[F] 2604.2 Interior trim.** Foam plastic used as interior trim shall comply with Sections 2604.2.1 through 2604.2.4.



**FIGURE 2603.9  
TERMITE INFESTATION PROBABILITY MAP**

**[F] 2604.2.1 Density.** The minimum density of the interior trim shall be 20 pcf (320 kg/m<sup>3</sup>).

**[F] 2604.2.2 Thickness.** The maximum thickness of the interior trim shall be 1/2 inch (12.7 mm) and the maximum width shall be 8 inches (204 mm).

**[F] 2604.2.3 Area limitation.** The interior trim shall not constitute more than 10 percent of the specific wall or ceiling areas to which it is attached.

**[F] 2604.2.4 Flame spread.** The flame spread index shall not exceed 75 where tested in accordance with ASTM E 84 or UL 723. The smoke-developed index shall not be limited.

**Exception:** When the interior trim material has been tested as an interior finish in accordance with NFPA 286 and complies with the acceptance criteria in Section 803.1.2.1, it shall not be required to be tested for flame spread index in accordance with ASTM E 84 or UL 723.

## SECTION 2605 PLASTIC VENEER

**2605.1 Interior use.** Where used within a building, plastic veneer shall comply with the interior finish requirements of Chapter 8.

**2605.2 Exterior use.** Exterior plastic veneer, other than plastic siding, shall be permitted to be installed on the exterior walls of buildings of any type of construction in accordance with all of the following requirements:

1. Plastic veneer shall comply with Section 2606.4.
2. Plastic veneer shall not be attached to any exterior wall to a height greater than 50 feet (15 240 mm) above grade.
3. Sections of plastic veneer shall not exceed 300 square feet (27.9 m<sup>2</sup>) in area and shall be separated by a minimum of 4 feet (1219 mm) vertically.

**Exception:** The area and separation requirements and the smoke-density limitation are not applicable to plastic veneer applied to buildings constructed of Type VB construction, provided the walls are not required to have a fire-resistance rating.

**2605.3 Plastic siding.** Plastic siding shall comply with the requirements of Sections 1404 and 1405.

## SECTION 2606 LIGHT-TRANSMITTING PLASTICS

**2606.1 General.** The provisions of this section and Sections 2607 through 2611 shall govern the quality and methods of application of light-transmitting plastics for use as light-transmitting materials in buildings and structures. Foam plastics shall comply with Section 2603. Light-transmitting plastic materials that meet the other code requirements for walls

and roofs shall be permitted to be used in accordance with the other applicable chapters of the code.

**2606.2 Approval for use.** Sufficient technical data shall be submitted to substantiate the proposed use of any light-transmitting material, as approved by the building official and subject to the requirements of this section.

**2606.3 Identification.** Each unit or package of light-transmitting plastic shall be identified with a mark or decal satisfactory to the building official, which includes identification as to the material classification.

**2606.4 Specifications.** Light-transmitting plastics, including thermoplastic, thermosetting or reinforced thermosetting plastic material, shall have a self-ignition temperature of 650°F (343°C) or greater where tested in accordance with ASTM D 1929; a smoke-developed index not greater than 450 where tested in the manner intended for use in accordance with ASTM E 84 or UL 723, or a maximum average smoke density rating not greater than 75 where tested in the thickness intended for use in accordance with ASTM D 2843 and shall conform to one of the following combustibility classifications:

**Class CC1:** Plastic materials that have a burning extent of 1 inch (25 mm) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635.

**Class CC2:** Plastic materials that have a burning rate of 2 1/2 inches per minute (1.06 mm/s) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635.

**2606.5 Structural requirements.** Light-transmitting plastic materials in their assembly shall be of adequate strength and durability to withstand the loads indicated in Chapter 16. Technical data shall be submitted to establish stresses, maximum unsupported spans and such other information for the various thicknesses and forms used as deemed necessary by the building official.

**2606.6 Fastening.** Fastening shall be adequate to withstand the loads in Chapter 16. Proper allowance shall be made for expansion and contraction of light-transmitting plastic materials in accordance with accepted data on the coefficient of expansion of the material and other material in conjunction with which it is employed.

**2606.7 Light-diffusing systems.** Unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, light-diffusing systems shall not be installed in the following occupancies and locations:

1. Group A with an occupant load of 1,000 or more.
2. Theaters with a stage and proscenium opening and an occupant load of 700 or more.
3. Group I-2.
4. Group I-3.
5. Interior exit stairways and ramps and exit passageways.

**2606.7.1 Support.** Light-transmitting plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers. Hangers shall be at least No. 12 steel-wire gage (0.106 inch) galvanized wire or equivalent.

**2606.7.2 Installation.** Light-transmitting plastic diffusers shall comply with Chapter 8 unless the light-transmitting plastic diffusers will fall from the mountings before igniting, at an ambient temperature of at least 200°F (111°C) below the ignition temperature of the panels. The panels shall remain in place at an ambient room temperature of 175°F (79°C) for a period of not less than 15 minutes.

**2606.7.3 Size limitations.** Individual panels or units shall not exceed 10 feet (3048 mm) in length nor 30 square feet (2.79 m<sup>2</sup>) in area.

**2606.7.4 Fire suppression system.** In buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, plastic light-diffusing systems shall be protected both above and below unless the sprinkler system has been specifically approved for installation only above the light-diffusing system. Areas of light-diffusing systems that are protected in accordance with this section shall not be limited.

**2606.7.5 Electrical luminaires.** Light-transmitting plastic panels and light-diffuser panels that are installed in approved electrical luminaires shall comply with the requirements of Chapter 8 unless the light-transmitting plastic panels conform to the requirements of Section 2606.7.2. The area of approved light-transmitting plastic materials that are used in required exits or corridors shall not exceed 30 percent of the aggregate area of the ceiling in which such panels are installed, unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**2606.8 Partitions.** Light-transmitting plastics used in or as partitions shall comply with the requirements of Chapters 6 and 8.

**2606.9 Bathroom accessories.** Light-transmitting plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures and similar accessory units. Safety glazing shall be provided in accordance with Chapter 24.

**2606.10 Awnings, patio covers and similar structures.** Awnings constructed of light-transmitting plastics shall be constructed in accordance with the provisions specified in Section 3105 and Chapter 32 for projections. Patio covers constructed of light-transmitting plastics shall comply with Section 2606. Light-transmitting plastics used in canopies at motor fuel-dispensing facilities shall comply with Section 2606, except as modified by Section 406.7.2.

**2606.11 Greenhouses.** Light-transmitting plastics shall be permitted in lieu of plain glass in greenhouses.

**2606.12 Solar collectors.** Light-transmitting plastic covers on solar collectors having noncombustible sides and bottoms shall be permitted on buildings not over three stories above

grade plane or 9,000 square feet (836.1 m<sup>2</sup>) in total floor area, provided the light-transmitting plastic cover does not exceed 33.33 percent of the roof area for CC1 materials or 25 percent of the roof area for CC2 materials.

**Exception:** Light-transmitting plastic covers having a thickness of 0.010 inch (0.3 mm) or less or shall be permitted to be of any plastic material provided the area of the solar collectors does not exceed 33.33 percent of the roof area.

## SECTION 2607 LIGHT-TRANSMITTING PLASTIC WALL PANELS

**2607.1 General.** Light-transmitting plastics shall not be used as wall panels in exterior walls in occupancies in Groups A-1, A-2, H, I-2 and I-3. In other groups, light-transmitting plastics shall be permitted to be used as wall panels in exterior walls, provided that the walls are not required to have a fire-resistance rating and the installation conforms to the requirements of this section. Such panels shall be erected and anchored on a foundation, waterproofed or otherwise protected from moisture absorption and sealed with a coat of mastic or other approved waterproof coating. Light-transmitting plastic wall panels shall also comply with Section 2606.

**2607.2 Installation.** Exterior wall panels installed as provided for herein shall not alter the type of construction classification of the building.

**2607.3 Height limitation.** Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade plane, except as allowed by Section 2607.5.

**2607.4 Area limitation and separation.** The maximum area of a single wall panel and minimum vertical and horizontal separation requirements for exterior light-transmitting plastic wall panels shall be as provided for in Table 2607.4. The maximum percentage of wall area of any story in light-transmitting plastic wall panels shall not exceed that indicated in Table 2607.4 or the percentage of unprotected openings permitted by Section 705.8, whichever is smaller.

### Exceptions:

1. In structures provided with approved flame barriers extending 30 inches (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation is not required at the floor except that provided by the vertical thickness of the flame barrier projection.
2. Veneers of approved weather-resistant light-transmitting plastics used as exterior siding in buildings of Type V construction in compliance with Section 1406.
3. The area of light-transmitting plastic wall panels in exterior walls of greenhouses shall be exempt from the area limitations of Table 2607.4 but shall be limited as required for unprotected openings in accordance with Section 704.8.

**TABLE 2607.4**  
**AREA LIMITATION AND SEPARATION REQUIREMENTS FOR LIGHT-TRANSMITTING PLASTIC WALL PANELS<sup>a</sup>**

FIRE SEPARATION DISTANCE (feet)	CLASS OF PLASTIC	MAXIMUM PERCENTAGE AREA OF EXTERIOR WALL IN PLASTIC WALL PANELS	MAXIMUM SINGLE AREA OF PLASTIC WALL PANELS (square feet)	MINIMUM SEPARATION OF PLASTIC WALL PANELS (feet)	
				Vertical	Horizontal
Less than 6	—	Not Permitted	Not Permitted	—	—
6 or more but less than 11	CC1	10	50	8	4
	CC2	Not Permitted	Not Permitted	—	—
11 or more but less than or equal to 30	CC1	25	90	6	4
	CC2	15	70	8	4
Over 30	CC1	50	Not Limited	3 <sup>b</sup>	0
	CC2	50	100	6 <sup>b</sup>	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

a. For combinations of plastic glazing and plastic wall panel areas permitted, see Section 2607.6.

b. For reductions in vertical separation allowed, see Section 2607.4.

**2607.5 Automatic sprinkler system.** Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum percentage area of exterior wall in any story in light-transmitting plastic wall panels and the maximum square footage of a single area given in Table 2607.4 shall be increased 100 percent, but the area of light-transmitting plastic wall panels shall not exceed 50 percent of the wall area in any story, or the area permitted by Section 705.8 for unprotected openings, whichever is smaller. These installations shall be exempt from height limitations.

**2607.6 Combinations of glazing and wall panels.** Combinations of light-transmitting plastic glazing and light-transmitting plastic wall panels shall be subject to the area, height and percentage limitations and the separation requirements applicable to the class of light-transmitting plastic as prescribed for light-transmitting plastic wall panel installations.

increased to a maximum of 50 percent of the wall face of the story in which it is installed with no limit on the maximum dimension or area of a single pane of glazing.

2. Approved flame barriers extending 30 inches (762 mm) beyond the exterior wall in the plane of the floor, or vertical panels not less than 4 feet (1219 mm) in height, shall be installed between glazed units located in adjacent stories.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

3. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade level.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

## SECTION 2608 LIGHT-TRANSMITTING PLASTIC GLAZING

**2608.1 Buildings of Type VB construction.** Openings in the exterior walls of buildings of Type VB construction, where not required to be protected by Section 705, shall be permitted to be glazed or equipped with light-transmitting plastic. Light-transmitting plastic glazing shall also comply with Section 2606.

**2608.2 Buildings of other types of construction.** Openings in the exterior walls of buildings of types of construction other than Type VB, where not required to be protected by Section 705, shall be permitted to be glazed or equipped with light-transmitting plastic in accordance with Section 2606 and all of the following:

1. The aggregate area of light-transmitting plastic glazing shall not exceed 25 percent of the area of any wall face of the story in which it is installed. The area of a single pane of glazing installed above the first story above grade plane shall not exceed 16 square feet (1.5 m<sup>2</sup>) and the vertical dimension of a single pane shall not exceed 4 feet (1219 mm).

**Exception:** Where an automatic sprinkler system is provided throughout in accordance with Section 903.3.1.1, the area of allowable glazing shall be

## SECTION 2609 LIGHT-TRANSMITTING PLASTIC ROOF PANELS

**2609.1 General.** Light-transmitting plastic roof panels shall comply with this section and Section 2606. Light-transmitting plastic roof panels shall not be installed in Groups H, I-2 and I-3. In all other groups, light-transmitting plastic roof panels shall comply with any one of the following conditions:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The roof construction is not required to have a fire-resistance rating by Table 601.
3. The roof panels meet the requirements for roof coverings in accordance with Chapter 15.

**2609.2 Separation.** Individual roof panels shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

**Exceptions:**

1. The separation between roof panels is not required in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2. The separation between roof panels is not required in low-hazard occupancy buildings complying with the conditions of Section 2609.4, Exception 2 or 3.

**2609.3 Location.** Where exterior wall openings are required to be protected by Section 705.8, a roof panel shall not be installed within 6 feet (1829 mm) of such exterior wall.

**2609.4 Area limitations.** Roof panels shall be limited in area and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 2609.4.

**Exceptions:**

1. The area limitations of Table 2609.4 shall be permitted to be increased by 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Low-hazard occupancy buildings, such as swimming pool shelters, shall be exempt from the area limitations of Table 2609.4, provided that the buildings do not exceed 5,000 square feet (465 m<sup>2</sup>) in area and have a minimum fire separation distance of 10 feet (3048 mm).
3. Greenhouses that are occupied for growing plants on a production or research basis, without public access, shall be exempt from the area limitations of Table 2609.4 provided they have a minimum fire separation distance of 4 feet (1220 mm).
4. Roof coverings over terraces and patios in occupancies in Group R-3 shall be exempt from the area limitations of Table 2609.4 and shall be permitted with light-transmitting plastics.

**TABLE 2609.4  
AREA LIMITATIONS FOR LIGHT-TRANSMITTING  
PLASTIC ROOF PANELS**

CLASS OF PLASTIC	MAXIMUM AREA OF INDIVIDUAL ROOF PANELS (square feet)	MAXIMUM AGGREGATE AREA OF ROOF PANELS (percent of floor area)
CC1	300	30
CC2	100	25

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

**SECTION 2610  
LIGHT-TRANSMITTING PLASTIC SKYLIGHT  
GLAZING**

**2610.1 Light-transmitting plastic glazing of skylight assemblies.** Skylight assemblies glazed with light-transmitting plastic shall conform to the provisions of this section and Section 2606. Unit skylights glazed with light-transmitting plastic shall also comply with Section 2405.5.

**Exception:** Skylights in which the light-transmitting plastic conforms to the required roof-covering class in accordance with Section 1505.

**2610.2 Mounting.** The light-transmitting plastic shall be mounted above the plane of the roof on a curb constructed in accordance with the requirements for the type of construction classification, but at least 4 inches (102 mm) above the plane of the roof. Edges of the light-transmitting plastic skylights or

domes shall be protected by metal or other approved noncombustible material, or the light transmitting plastic dome or skylight shall be shown to be able to resist ignition where exposed at the edge to a flame from a Class B brand as described in ASTM E 108 or UL 790. The Class B brand test shall be conducted on a skylight that is elevated to a height as specified in the manufacturer's installation instructions, but not less than 4 inches (102 mm).

**Exceptions:**

1. Curbs shall not be required for skylights used on roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) in occupancies in Group R-3 and on buildings with a nonclassified roof covering.
2. The metal or noncombustible edge material is not required where nonclassified roof coverings are permitted.

**2610.3 Slope.** Flat or corrugated light-transmitting plastic skylights shall slope at least four units vertical in 12 units horizontal (4:12). Dome-shaped skylights shall rise above the mounting flange a minimum distance equal to 10 percent of the maximum width of the dome but not less than 3 inches (76 mm).

**Exception:** Skylights that pass the Class B Burning Brand Test specified in ASTM E 108 or UL 790.

**2610.4 Maximum area of skylights.** Each skylight shall have a maximum area within the curb of 100 square feet (9.3 m<sup>2</sup>).

**Exception:** The area limitation shall not apply where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

**2610.5 Aggregate area of skylights.** The aggregate area of skylights shall not exceed 33<sup>1</sup>/<sub>3</sub> percent of the floor area of the room or space sheltered by the roof in which such skylights are installed where Class CC1 materials are utilized, and 25 percent where Class CC2 materials are utilized.

**Exception:** The aggregate area limitations of light-transmitting plastic skylights shall be increased 100 percent beyond the limitations set forth in this section where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

**2610.6 Separation.** Skylights shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

**Exceptions:**

1. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. In Group R-3, multiple skylights located above the same room or space with a combined area not exceeding the limits set forth in Section 2610.4.

**2610.7 Location.** Where exterior wall openings are required to be protected in accordance with Section 705, a skylight shall not be installed within 6 feet (1829 mm) of such exterior wall.

**2610.8 Combinations of roof panels and skylights.** Combinations of light-transmitting plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to roof panel installations.

## SECTION 2611

### LIGHT-TRANSMITTING PLASTIC INTERIOR SIGNS

**2611.1 General.** Light-transmitting plastic interior wall signs shall be limited as specified in Sections 2611.2 through 2611.4. Light-transmitting plastic interior wall signs in covered and open mall buildings shall comply with Section 402.16. Light-transmitting plastic interior signs shall also comply with Section 2606.

**2611.2 Aggregate area.** The sign shall not exceed 20 percent of the wall area.

**2611.3 Maximum area.** The sign shall not exceed 24 square feet (2.23 m<sup>2</sup>).

**2611.4 Encasement.** Edges and backs of the sign shall be fully encased in metal.

## SECTION 2612

### FIBER-REINFORCED POLYMER

**2612.1 General.** The provisions of this section shall govern the requirements and uses of fiber-reinforced polymer in and on buildings and structures.

**2612.2 Labeling and identification.** Packages and containers of fiber-reinforced polymer and their components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

**2612.3 Interior finishes.** Fiber-reinforced polymer used as interior finishes, decorative materials or trim shall comply with Chapter 8.

**2612.3.1 Foam plastic cores.** Fiber-reinforced polymer used as interior finish and which contains foam plastic cores shall comply with Chapter 8 and Chapter 26.

**2612.4 Light-transmitting materials.** Fiber-reinforced polymer used as light-transmitting materials shall comply with Sections 2606 through 2611 as required for the specific application.

**2612.5 Exterior use.** Fiber-reinforced polymer shall be permitted to be installed on the exterior walls of buildings of any type of construction when such polymers meet the requirements of Section 2603.5. Fireblocking shall be installed in accordance with Section 718.

#### Exceptions:

1. Compliance with Section 2603.5 is not required when all of the following conditions are met:

- 1.1. The fiber-reinforced polymer shall not exceed an aggregate total of 20 percent of the area of the specific wall to which it is attached, and no single architectural element shall exceed 10 percent of the area of the specific wall to which it is attached, and no contiguous set of architectural elements shall exceed 10 percent of the area of the specific wall to which they are attached.

- 1.2. The fiber-reinforced polymer shall have a flame spread index of 25 or less. The flame spread index requirement shall not be required for coatings or paints having a thickness of less than 0.036 inch (0.9 mm) that are applied directly to the surface of the fiber-reinforced polymer.

- 1.3. Fireblocking complying with Section 718.2.6 shall be installed.

- 1.4. The fiber-reinforced polymer shall be installed directly to a noncombustible substrate or be separated from the exterior wall by one of the following materials: corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm) at any point, aluminum having a minimum thickness of 0.019 inch (0.5 mm) or other approved noncombustible material.

2. Compliance with Section 2603.5 is not required when the fiber-reinforced polymer is installed on buildings that are 40 feet (12 190 mm) or less above grade when all of the following conditions are met:

- 2.1. The fiber-reinforced polymer shall meet the requirements of Section 1406.2.

- 2.2. Where the fire separation distance is 5 feet (1524 mm) or less, the area of the fiber-reinforced polymer shall not exceed 10 percent of the wall area. Where the fire separation distance is greater than 5 feet (1524 mm), there shall be no limit on the area of the exterior wall coverage using fiber-reinforced polymer.

- 2.3. The fiber-reinforced polymer shall have a flame spread index of 200 or less. The flame spread index requirements do not apply to coatings or paints having a thickness of less than 0.036 inch (0.9 mm) that are applied directly to the surface of the fiber-reinforced polymer.

- 2.4. Fireblocking complying with Section 718.2.6 shall be installed.

## SECTION 2613

### REFLECTIVE PLASTIC CORE INSULATION

**2613.1 General.** The provisions of this section shall govern the requirements and uses of reflective plastic core insulation in buildings and structures. Reflective plastic core insulation

## PLASTIC

shall comply with the requirements of Section 2613.2 and of one of the following: Section 2613.3 or 2613.4.

**2613.2 Identification.** Packages and containers of reflective plastic core insulation delivered to the job site shall show the manufacturer's or supplier's name, product identification and information sufficient to determine that the end use will comply with the code requirements.

**2613.3 Surface-burning characteristics.** Reflective plastic core insulation shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E 84 or UL 723. The reflective plastic core insulation shall be tested at the maximum thickness intended for use. Test specimen preparation and mounting shall be in accordance with ASTM E 2599.

**2613.4 Room corner test heat release.** Reflective plastic core insulation shall comply with the acceptance criteria of Section 803.1.2.1 when tested in accordance with NFPA 286 or UL 1715 in the manner intended for use and at the maximum thickness intended for use.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 27 – ELECTRICAL

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X																		
<i>Adopt only those sections that are listed below</i>						X														
<i>Chapter / Section</i>																				
2702.2.5						X														
2702.2.6						X														
2702.2.15		X																		
2702.2.21		X																		

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*





## CHAPTER 27

# ELECTRICAL

### SECTION 2701 GENERAL

**2701.1 Scope.** This chapter governs the electrical components, equipment and systems used in buildings and structures covered by this code. Electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of *California Electrical Code*.

### SECTION 2702 EMERGENCY AND STANDBY POWER SYSTEMS

**[F] 2702.1 Installation.** Emergency and standby power systems required by this code or the *California Fire Code* shall be installed in accordance with this code, NFPA 110 and 111.

**[F] 2702.1.1 Stationary generators.** Stationary emergency and standby power generators required by this code shall be listed in accordance with UL 2200.

**[F] 2702.2 Where required.** Emergency and standby power systems shall be provided where required by Sections 2702.2.1 through 2702.2.20.

**[F] 2702.2.1 Group A occupancies.** Emergency power shall be provided for emergency voice/alarm communication systems in Group A occupancies in accordance with Section 907.5.2.2.4.

**[F] 2702.2.2 Smoke control systems.** Standby power shall be provided for smoke control systems in accordance with Section 909.11.

**[F] 2702.2.3 Exit signs.** Emergency power shall be provided for *exit* signs in accordance with Section 1011.6.3.

**[F] 2702.2.4 Means of egress illumination.** Emergency power shall be provided for means of egress illumination in accordance with Section 1006.3.

**[F] 2702.2.5 Accessible means of egress elevators.** Standby power shall be provided for elevators that are part of an accessible means of egress in accordance with Section 1007.4.

**[F] 2702.2.6 Accessible means of egress platform lifts.** Standby power in accordance with this section or ASME A 18.1 shall be provided for platform lifts that are part of an accessible means of egress in accordance with Section 1007.5.

**[F] 2702.2.7 Horizontal sliding doors.** Standby power shall be provided for horizontal sliding doors in accordance with Section 1008.1.4.3.

**[F] 2702.2.8 Semiconductor fabrication facilities.** Emergency power shall be provided for semiconductor fabrication facilities in accordance with Section 415.10.10.

**[F] 2702.2.9 Membrane structures.** Standby power shall be provided for auxiliary inflation systems in accordance with Section 3102.8.2. Emergency power shall be pro-

vided for exit signs in temporary tents and membrane structures in accordance with the *California Fire Code*.

**[F] 2702.2.10 Hazardous materials.** Emergency or standby power shall be provided in occupancies with hazardous materials in accordance with Section 414.5.3.

**[F] 2702.2.11 Highly toxic and toxic materials.** Emergency power shall be provided for occupancies with highly *toxic* or *toxic* materials in accordance with the *California Fire Code*.

**[F] 2702.2.12 Organic peroxides.** Standby power shall be provided for occupancies with silane gas in accordance with the *California Fire Code*.

**[F] 2702.2.13 Pyrophoric materials.** Emergency power shall be provided for occupancies with silane gas in accordance with the *California Fire Code*.

**[F] 2702.2.14 Covered and open mall buildings.** Standby power shall be provided for voice/alarm communication systems in covered and open mall buildings in accordance with Section 402.7.3.

**[F] 2702.2.15 High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access.** Emergency and standby power shall be provided in high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access in accordance with Sections 403.4.7 and 403.4.8.

**[F] 2702.2.16 Underground buildings.** Emergency and standby power shall be provided in underground buildings in accordance with Sections 405.8 and 405.9.

**[F] 2702.2.17 Group I-3 occupancies.** Emergency power shall be provided for doors in Group I-3 occupancies in accordance with Section 408.4.2.

**[F] 2702.2.18 Airport traffic control towers.** Standby power shall be provided in airport traffic control towers in accordance with Section 412.3.4.

**[F] 2702.2.19 Elevators.** Standby power for elevators shall be provided as set forth in Sections 3003.1, 3007.9 and 3008.9.

**[F] 2702.2.20 Smokeproof enclosures.** Standby power shall be provided for smokeproof enclosures as required by Section 909.20.6.2.

**2702.2.21 Group L-Occupancy.** Emergency power shall be provided in Group L occupancies in accordance with this chapter and Section 443.4.6.1.

**[F] 2702.3 Maintenance.** Emergency and standby power systems shall be maintained and tested in accordance with the *California Fire Code*.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 28 – MECHANICAL SYSTEMS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>		X																		
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
<b>2802</b>		X																		

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 28

# MECHANICAL SYSTEMS

### SECTION 2801 GENERAL

**[M] 2801.1 Scope.** Mechanical appliances, equipment and systems shall be constructed, installed and maintained in accordance with the *California Mechanical Code*. Masonry chimneys, fireplaces and barbecues shall comply with the *California Mechanical Code* and Chapter 21 of this code.

**2802 Spark Arrestor. [SFM]** *All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester. The spark arrestor shall meet all of the following requirements:*

- 1. The net free area of the spark arrester shall not be less than four times the net free area of the outlet of the chimney flue it serves.*
- 2. The spark arrester screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.*
- 3. Openings shall not permit the passage of spheres having a diameter larger than  $\frac{1}{2}$  inch (12.7 mm) and shall not block the passage of spheres having a diameter of less than  $\frac{3}{8}$  inch (9.5 mm).*
- 4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.*



## CHAPTER 29

# PLUMBING SYSTEMS

(Not Adopted by the State of California)

Refer to California Plumbing Code, Title 24, Part 5

### SECTION 2901 GENERAL

**[P] 2901.1 Scope.** The provisions of this chapter and the *California Plumbing Code* shall govern the erection, installation, alteration, repairs, relocation, replacement, addition to, use or maintenance of plumbing equipment and systems. Toilet and bathing rooms shall be constructed in accordance with Section 1210. Plumbing systems and equipment shall be constructed, installed and maintained in accordance with the *California Plumbing Code*. Private sewage disposal systems shall conform to the *California Private Sewage Disposal Code*.

For minimum plumbing fixture requirements, see Table 422.1 of the *California Plumbing Code*.

### SECTION 2902 MINIMUM PLUMBING FACILITIES

**[P] 2902.1 Minimum number of fixtures.** Plumbing fixtures shall be provided for the type of occupancy and in the minimum number shown in Table 2902.1. Types of occupancies

not shown in Table 2902.1 shall be considered individually by the building official. The number of occupants shall be determined by this code. Occupancy classification shall be determined in accordance with Chapter 3.

**[P] 2902.1.1 Fixture calculations.** To determine the occupant load of each sex, the total occupant load shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the occupant load of each sex in accordance with Table 2902.1. Fractional numbers resulting from applying the fixture ratios of Table 2902.1 shall be rounded up to the next whole number. For calculations involving multiple occupancies, such fractional numbers for each occupancy shall first be summed and then rounded up to the next whole number.

**Exception:** The total occupant load shall not be required to be divided in half where approved statistical data indicate a distribution of the sexes of other than 50 percent of each sex.

**[P] TABLE 2902.1  
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES<sup>a</sup>  
(See Sections 2902.2 and 2902.3)**

No.	CLASSIFICATION	OCCUPANCY	DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 419.2 OF THE CALIFORNIA PLUMBING CODE)		LAVATORIES		BATHTUBS/ SHOWERS	DRINKING FOUNTAINS <sup>a,f</sup> (SEE SECTION 410.1 OF THE CALIFORNIA PLUMBING CODE)	OTHER
				MALE	FEMALE	MALE	FEMALE			
1	Assembly (continued)	A-1 <sup>d</sup>	Theaters and other buildings for the performing arts and motion pictures	1 per 125	1 per 65	1 per 200		—	1 per 500	1 service sink
		A-2 <sup>d</sup>	Nightclubs, bars, taverns, dance halls and buildings for similar purposes	1 per 40	1 per 40	1 per 75		—	1 per 500	1 service sink
			Restaurants, banquet halls and food courts	1 per 75	1 per 75	1 per 200		—	1 per 500	1 service sink
		A-3 <sup>d</sup>	Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums	1 per 125	1 per 65	1 per 200		—	1 per 500	1 service sink
			Passenger terminals and transportation facilities	1 per 500	1 per 500	1 per 750		—	1 per 1,000	1 service sink
			Places of worship and other religious services	1 per 150	1 per 75	1 per 200		—	1 per 1,000	1 service sink

(continued)



**[P] TABLE 2902.1—(continued)**  
**MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES<sup>a</sup>**  
**(See Sections 2902.2 and 2902.3)**

No.	CLASSIFICATION	OCCUPANCY	DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 419.2 OF THE INTERNATIONAL PLUMBING CODE)		LAVATORIES		BATHTUBS/ SHOWERS	DRINKING FOUNTAINS <sup>e,f</sup> (SEE SECTION 410.1 OF THE INTERNATIONAL PLUMBING CODE)	OTHER
				MALE	FEMALE	MALE	FEMALE			
1	Assembly	A-4	Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150	—	1 per 1,000	1 service sink
		A-5	Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150	—	1 per 1,000	1 service sink
2	Business	B	Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial and similar uses	1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50		1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80		—	1 per 100	1 service sink <sup>g</sup>
3	Educational	E	Educational facilities	1 per 50		1 per 50		—	1 per 100	1 service sink
4	Factory and industrial	F-1 and F-2	Structures in which occupants are engaged in work fabricating, assembling or processing of products or materials	1 per 100		1 per 100		See Section 411 of the <i>California Plumbing Code</i>	1 per 400	1 service sink
5	Institutional	I-1	Residential care	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		I-2	Hospitals, ambulatory nursing home care recipient <sup>b</sup>	1 per per room <sup>c</sup>		1 per per room <sup>c</sup>		1 per 15	1 per 100	1 service sink
			Employees, other than residential care <sup>b</sup>	1 per 25		1 per 35		—	1 per 100	—
			Visitors, other than residential care	1 per 75		1 per 100		—	1 per 500	—
		I-3	Prisons <sup>b</sup>	1 per cell		1 per cell		1 per 15	1 per 100	1 service sink
		I-3	Reformatories, detention centers and correctional centers <sup>b</sup>	1 per 15		1 per 15		1 per 15	1 per 100	1 service sink
			Employees <sup>b</sup>	1 per 25		1 per 35		—	1 per 100	—
		I-4	Adult day care and child day care	1 per 15		1 per 15		1	1 per 100	1 service sink

(continued)

**[P] TABLE 2902.1—continued**  
**MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES<sup>a</sup>**  
**(See Sections 2902.2 and 2902.3)**

No.	CLASSIFICATION	OCCUPANCY	DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 419.2 OF THE CALIFORNIA PLUMBING CODE)		LAVATORIES		BATHTUBS OR SHOWERS	DRINKING FOUNTAINS <sup>e,f</sup> (SEE SECTION 410.1 OF THE CALIFORNIA PLUMBING CODE)	OTHER
				MALE	FEMALE	MALE	FEMALE			
6	Mercantile	M	Retail stores, service stations, shops, salesrooms, markets and shopping centers	1 per 500		1 per 750		—	1 per 1,000	1 service sink <sup>g</sup>
7	Residential	R-1	Hotels, motels, boarding houses (transient)	1 per sleeping unit		1 per sleeping unit		1 per sleeping unit	—	1 service sink
		R-2	Dormitories, fraternities, sororities and boarding houses (not transient)	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		R-2	Apartment house	1 per dwelling unit		1 per dwelling unit		1 per dwelling unit	—	1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units
		R-3	One- and two-family dwellings	1 per dwelling unit		1 per 10		1 per dwelling unit	—	1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit
		R-3	Congregate living facilities with 16 or fewer persons	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		R-4	Congregate living facilities with 16 or fewer persons	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
8	Storage	S-1 S-2	Structures for the storage of goods, warehouses, storehouses and freight depots, low and moderate hazard	1 per 100		1 per 100		See Section 411 of the <i>California Plumbing Code</i>	1 per 1,000	1 service sink

- a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code.
- b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.
- c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted where such room is provided with direct access from each patient sleeping unit and with provisions for privacy.
- d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.
- e. The minimum number of required drinking fountains shall comply with Table 2902.1 and Chapter 11.
- f. Drinking fountains are not required for an occupant load of 15 or fewer.
- g. For business and mercantile occupancies with an occupant load of 15 or fewer, service sinks shall not be required.

**[P] 2902.1.2 Family or assisted-use toilet and bath fixtures.** Fixtures located within family or assisted-use toilet and bathing rooms required by Section 1109.2.1 are permitted to be included in the number of required fixtures for either the male or female occupants in assembly and mercantile occupancies.

**[P] 2902.2 Separate facilities.** Where plumbing fixtures are required, separate facilities shall be provided for each sex.

**Exceptions:**

1. Separate facilities shall not be required for dwelling units and sleeping units.
2. Separate facilities shall not be required in structures or tenant spaces with a total occupant load, including both employees and customers, of 15 or less.
3. Separate facilities shall not be required in mercantile occupancies in which the maximum occupant load is 100 or less.

**[P] 2902.2.1 Family or assisted-use toilet facilities serving as separate facilities.** Where a building or tenant space requires a separate toilet facility for each sex and each toilet facility is required to have only one water closet, two family/assisted-use toilet facilities shall be permitted to serve as the required separate facilities. Family or assisted-use toilet facilities shall not be required to be identified for exclusive use by either sex as required by Section 2902.4.

**[P] 2902.3 Employee and public toilet facilities.** Customers, patrons and visitors shall be provided with public toilet facilities in structures and tenant spaces intended for public utilization. The number of plumbing fixtures located within the required toilet facilities shall be provided in accordance with Section 2902.1 for all users. Employees shall be provided with toilet facilities in all occupancies. Employee toilet facilities shall either be separate or combined employee and public toilet facilities.

**Exception:** Public toilet facilities shall not be required in open or enclosed parking garages. Toilet facilities shall not be required in parking garages where there are no parking attendants.

**[P] 2902.3.1 Access.** The route to the public toilet facilities required by Section 2902.3 shall not pass through kitchens, storage rooms or closets. Access to the required facilities shall be from within the building or from the exterior of the building. All routes shall comply with the accessibility requirements of this code. The public shall have access to the required toilet facilities at all times that the building is occupied.

**[P] 2902.3.2 Location of toilet facilities in occupancies other than malls.** In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

**Exception:** The location and maximum travel distances to required employee facilities in factory and industrial occupancies are permitted to exceed that required by this section, provided that the location and maximum travel distance are approved.

**[P] 2902.3.3 Location of toilet facilities in malls.** In covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 440 mm). In mall buildings, the required facilities shall be based on total square footage (m<sup>2</sup>) within a covered mall building or within the perimeter line of an open mall building, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum travel distance to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum travel distance shall be measured from the employees' work area of the store or tenant space.

**[P] 2902.3.4 Pay facilities.** Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

**[P] 2902.3.5 Door locking.** Where a toilet room is provided for the use of multiple occupants, the egress door for the room shall not be lockable from the inside of the room. This section does not apply to family or assisted-use toilet rooms.

**[P] 2902.4 Signage.** Required public facilities shall be designated by a legible sign for each sex. Signs shall be readily visible and located near the entrance to each toilet facility. Signs for accessible toilet facilities shall comply with Section 1110.

**[P] 2902.4.1 Directional signage.** Directional signage indicating the route to the public facilities shall be posted in accordance with Section 3107. Such signage shall be located in a corridor or aisle, at the entrance to the facilities for customers and visitors.

**[P] 2902.5 Drinking fountain location.** Drinking fountains shall not be required to be located in individual tenant spaces provided that public drinking fountains are located within a travel distance of 500 feet of the most remote location in the tenant space and not more than one story above or below the tenant space. Where the tenant space is in a covered or open mall, such distance shall not exceed 300 feet. Drinking fountains shall be located on an accessible route.

\*



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 30 – ELEVATORS AND CONVEYING SYSTEMS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X						X	X		X	X	X								
Adopt entire chapter as amended (amended sections listed below)									X											
Adopt only those sections that are listed below		X	X	X	X	X														
Chapter / Section																				
3001.1			X		X															
3001.1w/ Exception						X														
3001.2		X																		
3001.3			X	X	X	X														
3001.4																				
3001.5		X																		
3002.4a – 3002.4.7a		X																		
3002.5		X																		
3002.9 – 3002.9.5		X																		
3003.2 – 3003.2.1.2		X																		
3003.3		X																		
3004.1		X																		
3004.3.1		X																		
3006.4.1		X																		
3006.5		X																		
3007.1		X																		
3007.7.1		X																		
3007.7.4		X																		
3007.2		X																		
3008.1.2		X																		
3008.2		X																		
> 3008.2.1		X																		
3008.3.1		X																		
3008.6		X																		
> 3008.8.1		X																		
3009									X											

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.



## CHAPTER 30

# ELEVATORS AND CONVEYING SYSTEMS

### SECTION 3001 GENERAL

**3001.1 Scope.** This chapter governs the design, construction, installation, alteration and repair of elevators and conveying systems and their components.

> **Exception:** [DSA-AC] For accessibility requirements for platform lifts and elevators, see California Code of Regulations, Title 8 and Title 24, Part 2, Chapter 11B, Sections 11B-206.6, 11B-206.7, 11B-407 and 11B-410.

**3001.2 Referenced standards.** Except as otherwise provided for in this code, the design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*, ASME A90.1, ASME B20.1, ALI ALCTV, and ASCE 24 for construction in flood hazard areas established in Section 1612.3.

**3001.3 Accessibility.** Passenger elevators and platform (wheelchair) lifts required to be accessible by Chapter 11A or 11B shall conform to Chapter 11A for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development or Chapter 11B for applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance.

**3001.4 Change in use.** A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**3001.5 Elevators utilized to transport hazardous materials.** Elevators utilized to transport hazardous materials shall also comply with the California Fire Code Section 2703.10.4

### SECTION 3002 HOISTWAY ENCLOSURES

**3002.1 Hoistway enclosure protection.** Elevator, dumbwaiter and other hoistway enclosures shall be shaft enclosures complying with Section 713.

**3002.1.1 Opening protectives.** Openings in hoistway enclosures shall be protected as required in Chapter 7.

**Exception:** The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I Emergency Recall Operation.

**3002.1.2 Hardware.** Hardware on opening protectives shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating

mechanisms shall be exempt from the fire test requirements.

**3002.2 Number of elevator cars in a hoistway.** Where four or more elevator cars serve all or the same portion of a building, the elevators shall be located in no fewer than two separate hoistways. Not more than four elevator cars shall be located in any single hoistway enclosure.

**3002.3 Emergency signs.** An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS.

#### Exceptions:

1. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with Section 1007.4.
2. The emergency sign shall not be required for elevators that are used for occupant self-evacuation in accordance with Section 3008.

**3002.4 Elevator car to accommodate ambulance stretcher.** Where elevators are provided in buildings four or more stories above, or four or more stories below, grade plane, at least one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate an ambulance stretcher 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners, in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall not be less than 3 inches (76 mm) in height and shall be placed inside on both sides of the hoistway door frame.

*The following California sections replace the corresponding model code section for applications specified in section 1.11 for the Office of the State Fire Marshal.*

**3002.4a General stretcher requirements.** All buildings and structures with one or more passenger service elevators shall be provided with not less than one medical emergency service elevator to all landings meeting the provisions of Section 3002.4a.

#### Exceptions:

1. Elevators in structures used only by maintenance and operating personnel.
2. Elevators in jails and penal institutions.
3. Elevators in buildings or structures where each landing is at ground level or is accessible at grade level or by a ramp.
4. Elevator(s) in two-story buildings or structures equipped with stairs of a configuration that will

accommodate the carrying of the gurney or stretcher as permitted by the local jurisdictional authority.

5. Elevators in buildings or structures less than four stories in height for which the local jurisdictional authority has granted an exception in the form of a written document.

**3002.4.1a Gurney size.** The medical emergency service elevator shall accommodate the loading and transport of an ambulance gurney or stretcher [maximum size 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners] in the horizontal position.

**3002.4.2a Hoistway doors.** The hoistway landing openings shall be provided with power-operated doors.

**3002.4.3a Elevator entrance openings and car size.** The elevator car shall be of such a size and arrangement to accommodate a 24-inch by 84-inch (610 mm by 2134 mm) ambulance gurney or stretcher with not less than 5-inch (127 mm) radius corners, in the horizontal, open position, shall be provided with a minimum clear distance between walls or between walls and door excluding return panels not less than 80 inches by 54 inches (2032 mm by 1372 mm), and a minimum distance from wall to return panel not less than 51 inches (1295 mm) with a 42-inch (1067 mm) side slide door.

**Exception:** The elevator car dimensions and/or the clear entrance opening dimensions may be altered where it can be demonstrated to the local jurisdictional authority's satisfaction that the proposed configuration will handle the designated gurney or stretcher with equivalent ease. Documentation from the local authority shall be provided to the Occupational Safety and Health Standards Board.

**3002.4.4a Elevator recall.** The elevator(s) designated the medical emergency elevator shall be equipped with a key switch to recall the elevator nonstop to the main floor. For the purpose of this section, elevators in compliance with Section 3003.2 shall be acceptable.

**3002.4.5a Designation.** Medical emergency elevators shall be identified by the international symbol (Star of Life) for emergency medical services.

**3002.4.6a Symbol size.** The symbol shall not be less than 3 inches (76 mm) in size.

**3002.4.7a Symbol location.** A symbol shall be permanently attached to each side of the hoistway door frame on the portion of the frame at right angles to the hallway or landing area. Each symbol shall be not less than 78 inches (1981 mm) and not more than 84 inches (2134 mm) above the floor level at the threshold.

- **3002.5 Emergency doors.** Emergency doors in blind hoistways as described in ASME A17.1-2004, section 2.11.1.2, and access panels as described in ASME A17.1-2004, section 2.11.1.4, are prohibited in accordance with California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

**3002.6 Prohibited doors.** Doors, other than hoistway doors and the elevator car door, shall be prohibited at the point of access to an elevator car unless such doors are readily openable from the car side without a key, tool, special knowledge or effort.

**3002.7 Common enclosure with stairway.** Elevators shall not be in a common shaft enclosure with a stairway.

**Exception:** Elevators within open parking garages need not be separated from stairway enclosures.

**3002.8 Glass in elevator enclosures.** Glass in elevator enclosures shall comply with Section 2409.1.

**3002.9 Photoelectric tube bypass switch.**

**3002.9.1** Elevators equipped with photoelectric tube devices which control the closing of automatic, power-operated car or hoistway doors, or both, shall have a switch in the car which, when actuated, will render the photoelectric tube device ineffective.

**3002.9.2** The switch shall be constant-pressure type, requiring not less than 10 pounds (44.5N) or more than 15 pounds (66.7 N) pressure to actuate.

**3002.9.3** The switch shall be located not less than 6 feet (1829 mm) or more than 6 feet 6 inches (1981 mm) above the car floor and shall be located in or adjacent to the operating panel.

**3002.9.4** The switch shall be clearly labeled **TO BE USED IN CASE OF FIRE ONLY**.

**3002.9.5** Switches shall be kept in working order or be removed when existing installations are arranged to comply with Section 3002.9.5, Exception 1 or 2.

**Exceptions:**

1. Elevators installed and maintained in compliance with Section 3003.
2. Where alternate means acceptable to the fire authority having jurisdiction are provided that will ensure the doors can close under adverse smoke conditions.

## SECTION 3003 EMERGENCY OPERATIONS

**[F] 3003.1 Standby power.** In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with Sections 3003.1.1 through 3003.1.4.

**[F] 3003.1.1 Manual transfer.** Standby power shall be manually transferable to all elevators in each bank.

**[F] 3003.1.2 One elevator.** Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

**[F] 3003.1.3 Two or more elevators.** Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate

all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, at least one elevator shall remain operable from the standby power source.

**[F] 3003.1.4 Venting.** Where standby power is connected to elevators, the machine room ventilation or air conditioning shall be connected to the standby power source.

**[F] 3003.2 Fire-fighters' emergency operation.** Elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**3003.2.1 Floor numbers.** Elevator hoistways shall have a floor number not less than 4 inches (102 mm) in height, placed on the walls and/or doors of the hoistway at intervals such that a person in a stalled elevator, upon opening the car door, can determine the floor position.

**3003.2.1.1 Fire signs.** All automatic elevators shall have not less than one sign at each landing printed on a contrasting background in letters not less than  $\frac{1}{2}$  inch (12.7 mm) high to read: **IN CASE OF FIRE USE STAIRWAY FOR EXIT. DO NOT USE ELEVATOR.**

**3003.2.1.2 Call and car operation buttons.** Automatic passenger elevators shall have call and car operation buttons within 60 inches (1524 mm) of the floor. Emergency telephones shall also be within 60 inches (1524 mm) of the floor.

**[F] 3003.3 Standardized fire service elevator keys.** All elevators shall be equipped to operate with a standardized fire service elevator key in accordance with the *California Fire Code*.

## SECTION 3004 HOISTWAY VENTING

**3004.1 Vents required.** Hoistways of elevators and dumbwaiters penetrating more than three stories shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.

**Exception:** Venting is not required for the following elevators and hoistways:

1. In occupancies of other than Groups R-1, R-2, R-2.1, I-2 and similar occupancies with overnight sleeping units, where the building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Sidewalk elevator hoistways.
3. Elevators contained within and serving open parking garages only.
4. Elevators within individual residential dwelling units.

**3004.2 Location of vents.** Vents shall be located at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air. Noncombustible ducts shall be permitted to pass through the elevator machine room, provided that portions of the ducts located outside the hoistway or machine room are enclosed by construction having not less than the fire-resistance rating required for the hoistway. Holes in the machine room floors for the passage of ropes, cables or other moving elevator equipment shall be limited as not to provide greater than 2 inches (51 mm) of clearance on all sides.

**3004.3 Area of vents.** Except as provided for in Section 3004.3.1, the area of the vents shall be not less than  $3\frac{1}{2}$  percent of the area of the hoistway nor less than 3 square feet (0.28 m<sup>2</sup>) for each elevator car, and not less than  $3\frac{1}{2}$  percent nor less than 0.5 square feet (0.047 m<sup>2</sup>) for each dumbwaiter car in the hoistway, whichever is greater. Of the total required vent area, not less than one-third shall be permanently open. Closed portions of the required vent area shall consist of openings glazed with annealed glass not greater than  $\frac{1}{8}$  inch (3.2 mm) in thickness.

**Exception:** The total required vent area shall not be required to be permanently open where all the vent openings automatically open upon detection of smoke in the elevator lobbies or hoistway, upon power failure and upon activation of a manual override control. The manual override control shall be capable of opening and closing the vents and shall be located in an approved location.

**3004.3.1 Reduced vent area.** Where mechanical ventilation conforming to the *California Mechanical Code* is provided, a reduction in the required vent area is allowed provided that all of the following conditions are met:

1. The occupancy is not in Group R-1, R-2, R-2.1 or I-2 or of a similar occupancy with overnight sleeping units.
2. The vents required by Section 3004.2 do not have outside exposure.
3. The hoistway does not extend to the top of the building.
4. The hoistway and machine room exhaust fan is automatically reactivated by thermostatic means.
5. Equivalent venting of the hoistway is accomplished.

**3004.4 Plumbing and mechanical systems.** Plumbing and mechanical systems shall not be located in an elevator hoistway enclosure.

**Exception:** Floor drains, sumps and sump pumps shall be permitted at the base of the hoistway enclosure provided they are indirectly connected to the plumbing system.

## SECTION 3005 CONVEYING SYSTEMS

**3005.1 General.** Escalators, moving walks, conveyors, personnel hoists and material hoists shall comply with the provisions of Sections 3005.2 through 3005.4.



**3005.2 Escalators and moving walks.** Escalators and moving walks shall be constructed of approved noncombustible and fire-retardant materials. This requirement shall not apply to electrical equipment, wiring, wheels, handrails and the use of  $\frac{1}{28}$ -inch (0.9 mm) wood veneers on balustrades backed up with noncombustible materials.

**3005.2.1 Enclosure.** Escalator floor openings shall be enclosed with shaft enclosures complying with Section 713.

**3005.2.2 Escalators.** Where provided in below-grade transportation stations, escalators shall have a clear width of not less than 32 inches (815 mm).

**Exception:** The clear width is not required in existing facilities undergoing alterations.

**3005.3 Conveyors.** Conveyors and conveying systems shall comply with ASME B20.1.

**3005.3.1 Enclosure.** Conveyors and related equipment connecting successive floors or levels shall be enclosed with shaft enclosures complying with Section 713.

**3005.3.2 Conveyor safeties.** Power-operated conveyors, belts and other material-moving devices shall be equipped with automatic limit switches which will shut off the power in an emergency and automatically stop all operation of the device.

**3005.4 Personnel and material hoists.** Personnel and material hoists shall be designed utilizing an approved method that accounts for the conditions imposed during the intended operation of the hoist device. The design shall include, but is not limited to, anticipated loads, structural stability, impact, vibration, stresses and seismic restraint. The design shall account for the construction, installation, operation and inspection of the hoist tower, car, machinery and control equipment, guide members and hoisting mechanism. Additionally, the design of personnel hoists shall include provisions for field testing and maintenance which will demonstrate that the hoist device functions in accordance with the design. Field tests shall be conducted upon the completion of an installation or following a major alteration of a personnel hoist.

## SECTION 3006 MACHINE ROOMS

**3006.1 Access.** An approved means of access shall be provided to elevator machine rooms and overhead machinery spaces.

**3006.2 Venting.** Elevator machine rooms that contain solid-state equipment for elevator operation shall be provided with an independent ventilation or air-conditioning system to protect against the overheating of the electrical equipment. The system shall be capable of maintaining temperatures within the range established for the elevator equipment.

**3006.3 Pressurization.** The elevator machine room serving a pressurized elevator hoistway shall be pressurized upon activation of a heat or smoke detector located in the elevator machine room.

**3006.4 Machine rooms and machinery spaces.** Elevator machine rooms and machinery spaces shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors.

### Exceptions:

1. Where machine rooms and machinery spaces do not abut and have no openings to the hoistway enclosure they serve the fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted to be reduced to a 1-hour fire-resistance rating.
2. In buildings four stories or less above grade plane where machine room and machinery spaces do not abut and have no openings to the hoistway enclosure they serve, the machine room and machinery spaces are not required to be fire-resistance rated.

**3006.4.1 Automatic sprinkler system.** *Automatic sprinklers shall not be required to be installed in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room where all the following are met:*

1. *Approved smoke detectors shall be installed in the elevator hoistway, elevator machine room, elevator machinery spaces, elevator control spaces, or elevator control rooms and connected to the building fire alarm system in accordance with Section 907.*
2. *Activation of any smoke detector located in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room shall cause the actuation of the building fire alarm notification appliances in accordance with Section 907.*
3. *Activation of any smoke detector located in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room shall cause all elevators having any equipment located in that elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room to recall nonstop to the appropriate designated floor in accordance with CCR Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*
4. *The elevator machine room, elevator machinery space, elevator control space, or elevator control room shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 712, or both. The fire-resistance rating shall not be less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies hav-*

ing a fire protection rating not less than that required for the hoistway enclosure doors. The exceptions to Section 3006.4 shall not apply.

5. The building fire alarm system shall be monitored by an approved supervising station in accordance with Section 907.
6. An approved sign shall be permanently displayed in the elevator machine room, elevator machinery space, elevator control space, or elevator control room in a conspicuous location with a minimum of 1½-inch letters on a contrasting background, stating:

**NO COMBUSTIBLE STORAGE  
PERMITTED IN THIS ROOM**

By Order of the Fire Marshal [or name of fire authority]

**3006.5 Shunt trip.** Where elevator hoistways or elevator machine rooms containing elevator control equipment are protected with automatic sprinklers, a means installed in accordance with NFPA 72, Section 21.4, Elevator Shutdown, shall be provided to disconnect automatically the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting. The activation of sprinklers outside the hoistway or machine room shall not disconnect the main line power supply.

**3006.6 Plumbing systems.** Plumbing systems shall not be located in elevator equipment rooms.

## **SECTION 3007 FIRE SERVICE ACCESS ELEVATOR**

**3007.1 General.** Where required by Section 403.6.1, every floor of the building shall be served by fire service access elevators complying with Sections 3007.1 through 3007.10. Except as modified in this section, fire service access elevators shall be installed in accordance with this chapter and *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**3007.2 Phase I Emergency recall operation.** Actuation of any building fire alarm-initiating device shall initiate Phase I emergency recall operation on all fire service access elevators in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*. All other elevators shall remain in normal service unless Phase I emergency recall operation is manually initiated by a separate, required three-position, key-operated "Fire Recall" switch or automatically initiated by the associated elevator lobby, hoistway or elevator machine room smoke detectors. In addition, if the building also contains occupant evacuation elevators in accordance with Section 3008, an independent, three-position, key-operated "Fire Recall" switch conforming to the applicable requirements in *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* shall be provided at the designated level for each fire service access elevator.

**3007.3 Automatic sprinkler system.** The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise per-

mitted by Section 903.3.1.1.1 and as prohibited by Section 3007.3.1.

**3007.3.1 Prohibited locations.** Automatic sprinklers shall not be installed in elevator machine rooms, elevator machine spaces, and elevator hoistways of fire service access elevators.

**3007.3.2 Sprinkler system monitoring.** The sprinkler system shall have a sprinkler control valve supervisory switch and waterflow-initiating device provided for each floor that is monitored by the building's fire alarm system.

**3007.4 Water protection.** An approved method to prevent water from infiltrating into the hoistway enclosure from the operation of the automatic sprinkler system outside the enclosed fire service access elevator lobby shall be provided.

**3007.5 Shunt trip.** Means for elevator shutdown in accordance with Section 3006.5 shall not be installed on elevator systems used for fire service access elevators.

**3007.6 Hoistway enclosures.** The fire service access elevator hoistway shall be located in a shaft enclosure complying with Section 708.

**3007.6.1 Structural integrity of hoistway enclosures.** The fire service access elevator hoistway enclosure shall comply with Sections 403.2.3.1 through 403.2.3.4.

**3007.6.2 Hoistway lighting.** When fire-fighters' emergency operation is active, the entire height of the hoistway shall be illuminated at not less than 1 footcandle (11 lux) as measured from the top of the car of each fire service access elevator.

**3007.7 Fire service access elevator lobby.** The fire service access elevator shall open into a fire service access elevator lobby in accordance with Sections 3007.7.1 through 3007.7.5.

**Exception:** Where a fire service access elevator has two entrances onto a floor, the second entrance shall be permitted to open into an elevator lobby in accordance with Section 708.14.1.

**3007.7.1 Access.** The fire service access elevator lobby shall have direct access from the enclosed elevator lobby to a smokeproof enclosure complying with Section 909.20.

**Exception:** Access to a smokeproof enclosure shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance with Section 716.5.3.

**3007.7.2 Lobby enclosure.** The fire service access elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 3007.7.3.

**Exception:** Enclosed fire service access elevator lobbies are not required at the levels of exit discharge.

**3007.7.3 Lobby doorways.** Other than the door to the hoistway, each doorway to a fire service access elevator lobby shall be provided with a ¾-hour fire door assembly complying with Section 716.5. The fire door assembly

shall also comply with the smoke and draft control door assembly requirements of Section 716.5.3.1 with the UL 1784 test conducted without the artificial bottom seal.

**3007.7.4 Lobby size.** *Regardless of any number of fire service access elevators served by the same elevator lobby, the enclosed fire service access elevator lobby shall be not less than 150 square feet (14 m<sup>2</sup>) in area with a minimum dimension of 8 feet (2440 mm).*

**3007.7.5 Fire service access elevator symbol.** A pictorial symbol of a standardized design designating which elevators are fire service access elevators shall be installed on each side of the hoistway door frame on the portion of the frame at right angles to the fire service access elevator lobby. The fire service access elevator symbol shall be designed as shown in Figure 3007.7.5 and shall comply with the following:

1. The fire service access elevator symbol shall be not less than 3 inches (76 mm) in height.
2. The vertical center line of the fire service access elevator symbol shall be centered on the hoistway door frame. Each symbol shall not be less than 78 inches (1981 mm), and not more than 84 (2134 mm) inches above the finished floor at the threshold.



**FIGURE 3007.7.5  
FIRE SERVICE ACCESS ELEVATOR SYMBOL**

**3007.8 Elevator system monitoring.** The fire service access elevator shall be continuously monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.

**3007.9 Electrical power.** The following features serving each fire service access elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator hoistway lighting.
3. Elevator machine room ventilation and cooling equipment.
4. Elevator controller cooling equipment.

**3007.9.1 Protection of wiring or cables.** Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or standby power,

control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected by construction having a fire-resistance rating of not less than 2 hours, or shall be circuit integrity cable having a fire-resistance rating of not less than 2 hours.

**Exception:** Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operations.

**3007.10 Standpipe hose connection.** A Class I standpipe hose connection in accordance with Section 905 shall be provided in the interior exit stairway and ramp having direct access from the fire service access elevator lobby.

**3007.10.1 Access.** The exit enclosure containing the standpipe shall have access to the floor without passing through the fire service access elevator lobby.

## **SECTION 3008 OCCUPANT EVACUATION ELEVATORS**

**3008.1 General.** Where elevators are to be used for occupant self-evacuation during fires, all passenger elevators for general public use shall comply with Sections 3008.1 through 3008.11. Where other elevators are used for occupant self-evacuation, they shall also comply with these sections.

**3008.1.1 Additional exit stairway.** Where an additional means of egress is required in accordance with Section 403.5.2, an additional exit stairway shall not be required to be installed in buildings provided with occupant evacuation elevators complying with Section 3008.1.

**3008.1.2 Fire safety and evacuation plan.** The building shall have an approved fire safety and evacuation plan in accordance with the applicable requirements of Section 404 of the *California Fire Code*. The fire safety and evacuation plan shall incorporate specific procedures for the occupants using evacuation elevators.

**3008.2 Phase I Emergency recall operation.** An independent, three-position, key-operated "Fire Recall" switch complying with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* shall be provided at the designated level for each occupant evacuation elevator.

**3008.2.1 Operation.** The occupant evacuation elevators shall be used for occupant self-evacuation only in the normal elevator operating mode prior to Phase I Emergency Recall Operation in accordance with the requirements in *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* and the building's fire safety and evacuation plan.

**3008.2.2 Activation.** Occupant evacuation elevator systems shall be activated by any of the following:

1. The operation of an automatic sprinkler system complying with Section 3008.3;
2. Smoke detectors required by another provision of the code;
3. Approved manual controls.

**3008.3 Automatic sprinkler system.** The building shall be protected throughout by an approved, electrically supervised automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3008.3.1.

**3008.3.1 Prohibited locations.** Automatic sprinklers shall not be installed in elevator machine rooms and elevator machine spaces for occupant evacuation elevators *in accordance with this Section and 3006.4.1.*

**3008.3.2 Sprinkler system monitoring.** The sprinkler system shall have a sprinkler control valve supervisory switch and water flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

**3008.4 Water protection.** An approved method to prevent water from infiltrating into the hoistway enclosure from the operation of the automatic sprinkler system outside the enclosed occupant evacuation elevator lobby shall be provided.

**3008.5 Shunt trip.** Means for elevator shutdown in accordance with Section 3006.5 shall not be installed on elevator systems used for occupant evacuation elevators.

**3008.6 Hoistway enclosure protection.** Occupant evacuation elevator hoistways shall be located in shaft enclosures complying with Section 713.

**3008.6.1 Structural integrity of hoistway enclosures.** Occupant evacuation elevator hoistway enclosures shall comply with Sections 403.2.3.1 through 403.2.3.4.

**3008.7 Occupant evacuation elevator lobby.** The occupant evacuation elevators shall open into an elevator lobby in accordance with Sections 3008.7.1 through 3008.7.7.

**3008.7.1 Access.** The occupant evacuation elevator lobby shall have direct access to an interior exit stairway or ramp.

**3008.7.2 Lobby enclosure.** The occupant evacuation elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 3008.7.3.

**Exception:** Enclosed occupant evacuation elevator lobbies are not required at the levels of exit discharge.

**3008.7.3 Lobby doorways.** Other than the door to the hoistway, each doorway to an occupant evacuation elevator lobby shall be provided with a  $\frac{3}{4}$ -hour fire door assembly complying with Section 716.5. The fire door assembly shall also comply with the smoke and draft control assembly requirements of Section 716.5.3.1 with the UL 1784 test conducted without the artificial bottom seal.

**3008.7.3.1 Vision panel.** A vision panel shall be installed in each fire door assembly protecting the lobby doorway. The vision panel shall consist of fire-protection-rated glazing and shall be located to furnish clear vision of the occupant evacuation elevator lobby.

**3008.7.3.2 Door closing.** Each fire door assembly protecting the lobby doorway shall be automatic-closing

upon receipt of any fire alarm signal from the emergency voice/alarm communication system serving the building.

**3008.7.4 Lobby size.** Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 square feet (0.28 m<sup>2</sup>) per person, not less than 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area also shall accommodate one wheelchair space of 30 inches by 48 inches (760 mm by 1220 mm) for each 50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

**Exception:** The size of lobbies serving multiple banks of elevators shall have the minimum floor area approved on an individual basis and shall be consistent with the building's fire safety and evacuation plan.

**3008.7.5 Signage.** An approved sign indicating elevators are suitable for occupant self-evacuation shall be posted on all floors adjacent to each elevator call station serving occupant evacuation elevators.

**3008.7.6 Lobby status indicator.** Each occupant evacuation elevator lobby shall be equipped with a status indicator arranged to display all of the following information:

1. An illuminated green light and the message, "Elevators available for occupant evacuation," when the elevators are operating in normal service and the fire alarm system is indicating an alarm in the building.
2. An illuminated red light and the message, "Elevators out of service, use exit stairs" when the elevators are in Phase I emergency recall operation *or Phase II firefighters' emergency operation* in accordance with the requirements in *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.
3. No illuminated light or message when the elevators are operating in normal service.

**3008.7.7 Two-way communication system.** A two-way communication system shall be provided in each occupant evacuation elevator lobby for the purpose of initiating communication with the fire command center or an alternate location approved by the fire department.

**3008.7.7.1 Design and installation.** The two-way communication system shall include audible and visible signals and shall be designed and installed in accordance with the requirements in ICC A117.1.

**3008.7.7.2 Instructions.** Instructions for the use of the two-way communication system along with the location of the station shall be permanently located adjacent to each station. Signage shall comply with the ICC A117.1 requirements for visual characters.

**3008.8 Elevator system monitoring.** The occupant evacuation elevators shall be continuously monitored at the fire

command center or a central control point approved by the fire department and arranged to display all of the following information:

1. Floor location of each elevator car.
2. Direction of travel of each elevator car.
3. Status of each elevator car with respect to whether it is occupied.
4. Status of normal power to the elevator equipment, elevator controller cooling equipment, and elevator machine room ventilation and cooling equipment.
5. Status of standby or emergency power system that provides backup power to the elevator equipment, elevator controller cooling equipment, and elevator machine room ventilation and cooling equipment.
6. Activation of any fire alarm initiating device in any elevator lobby, elevator machine room or machine space, or elevator hoistway.

**3008.8.1 Elevator recall.** The fire command center or an alternate location approved by the fire department shall be provided with the means to manually initiate a Phase I Emergency Recall of the occupant evacuation elevators in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*

**3008.9 Electrical power.** The following features serving each occupant evacuation elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator machine room ventilation and cooling equipment.
3. Elevator controller cooling equipment.

**3008.9.1 Protection of wiring or cables.** Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected by construction having a fire-resistance rating of not less than 2 hours, or shall be circuit integrity cable having a fire-resistance rating of not less than 2 hours.

**Exception:** Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operations.

**3008.10 Emergency voice/alarm communication system.** The building shall be provided with an emergency voice/alarm communication system. The emergency voice/alarm communication system shall be accessible to the fire department. The system shall be provided in accordance with Section 907.2.12.2.

**3008.10.1 Notification appliances.** No fewer than one audible and one visible notification appliance shall be installed within each occupant evacuation elevator lobby.

**3008.11 Hazardous material areas.** No building areas shall contain hazardous materials exceeding the maximum allowable quantities per control area as addressed in Section 414.2.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 31– SPECIAL CONSTRUCTION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>							X	X	X	X	X	X								
<i>Adopt entire chapter as amended (amended sections listed below)</i>			X	X																
<i>Adopt only those sections that are listed below</i>		X				X														
<i>Chapter / Section</i>																				
3101		X																		
3102.1		X																		
3102.3.1		X																		
3103		X																		
3104		X																		
3104.2, Exception 2					X	X														
3105		X																		
3105.4		X																		
3106		X																		
3109			†	†																
3109.4.4-3109.6	X																			
3110		X																		
3111		X																		

*The state agency does not adopt sections identified by the following symbol: †*

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 31

# SPECIAL CONSTRUCTION

### SECTION 3101 GENERAL

**3101.1 Scope.** The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, automatic vehicular gates, awnings and canopies, marquees, signs, and towers and antennas.

### SECTION 3102 MEMBRANE STRUCTURES

**3102.1 General.** The provisions of Sections 3102.1 through 3102.8 shall apply to air-supported, air-inflated, membrane-covered cable and membrane-covered frame structures, collectively known as membrane structures, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the *California Fire Code*. Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, greenhouses and similar facilities not used for human occupancy are required to meet only the requirements of Sections 3102.3.1 and 3102.7. Membrane structures erected on a building, balcony, deck or other structure for any period of time shall comply with this section.

**3102.2 Definitions.** The following terms are defined in Chapter 2:

**AIR-INFLATED STRUCTURE.**

**AIR-SUPPORTED STRUCTURE.**

**Double skin.**

**Single skin.**

**CABLE-RESTRAINED, AIR-SUPPORTED STRUCTURE.**

**MEMBRANE-COVERED CABLE STRUCTURE.**

**MEMBRANE-COVERED FRAME STRUCTURE.**

**NONCOMBUSTIBLE MEMBRANE STRUCTURE.**

**3102.3 Type of construction.** Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IV construction. Other membrane structures shall be classified as Type V construction.

**Exception:** Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of NFPA 701.

**3102.3.1 Membrane and interior liner material.** Membranes and interior liners shall be either noncombustible as set forth in Section 703.5 or *shall be flame resistant in accordance with appropriate standards set forth in CCR, Title 19, Division 1, Chapter 8. Tops and sidewalls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).*

**Exception:** Plastic less than 20 mil (0.5 mm) in thickness used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of NFPA 701.

**3102.4 Allowable floor areas.** The area of a membrane structure shall not exceed the limitations set forth in Table 503, except as provided in Section 506.

**3102.5 Maximum height.** Membrane structures shall not exceed one story nor shall such structures exceed the height limitations in feet set forth in Table 503.

**Exception:** Noncombustible membrane structures serving as roofs only.

**3102.6 Mixed construction.** Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

**3102.6.1 Noncombustible membrane.** A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or atrium of a building of any type of construction provided it is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

**3102.6.1.1 Membrane.** A membrane meeting the fire propagation performance criteria of NFPA 701 shall be permitted to be used as the roof or as a skylight on buildings of Types IIB, III, IV and V construction, provided it is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

**3102.7 Engineering design.** The structure shall be designed and constructed to sustain dead loads; loads due to tension or inflation; live loads including wind, snow or flood and seismic loads and in accordance with Chapter 16.

**3102.8 Inflation systems.** Air-supported and air-inflated structures shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of Sections 3102.8.1 through 3102.8.3.

**3102.8.1 Equipment requirements.** This inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required



inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

**3102.8.1.1 Auxiliary inflation system.** In addition to the primary inflation system, in buildings larger than 1,500 square feet (140 m<sup>2</sup>) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

**3102.8.1.2 Blower equipment.** Blower equipment shall meet all of the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the building official to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be approved.

**3102.8.2 Standby power.** Wherever an auxiliary inflation system is required, an approved standby power-generating system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. Standby power shall be capable of operating independently for not less than 4 hours.

**3102.8.3 Support provisions.** A system capable of supporting the membrane in the event of deflation shall be provided for in air-supported and air-inflated structures having an occupant load of 50 or more or where covering a swimming pool regardless of occupant load. The support system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes not less than 7 feet (2134 mm) above the floor, seating area or surface of the water.

## SECTION 3103 TEMPORARY STRUCTURES

**3103.1 General.** The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. Tents and other membrane structures erected for a period of less than 180 days shall comply with the *California Fire Code*.

Those erected for a longer period of time shall comply with applicable sections of this code.

**3103.1.1 Permit required.** Temporary structures that cover an area greater than 120 square feet (11.16 m<sup>2</sup>), including connecting areas or spaces with a common means of egress or entrance which are used or intended to be used for the gathering together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a permit from the building official.

**3103.2 Construction documents.** A permit application and construction documents shall be submitted for each installation of a temporary structure. The construction documents shall include a site plan indicating the location of the temporary structure and information delineating the means of egress and the occupant load.

**3103.3 Location.** Temporary structures shall be located in accordance with the requirements of Table 602 based on the fire-resistance rating of the exterior walls for the proposed type of construction.

**3103.4 Means of egress.** Temporary structures shall conform to the means of egress requirements of Chapter 10 and shall have an exit access travel distance of 100 feet (30 480 mm) or less.

## SECTION 3104 PEDESTRIAN WALKWAYS AND TUNNELS

**3104.1 General.** This section shall apply to connections between buildings such as pedestrian walkways or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or the number of stories or height of connected buildings.

**3104.2 Separate structures.** Connected buildings shall be considered to be separate structures.

### Exceptions:

1. Buildings on the same lot in accordance with Section 503.1.2 shall be considered a single structure.
2. *[DSA-AC and HCD 1-AC] For purposes of accessibility as required by Chapters 11A and 11B, structurally connected buildings, buildings connected by stairs, walkways, or roofs, and buildings with multiple wings shall be considered one structure.* ||

**3104.3 Construction.** The pedestrian walkway shall be of noncombustible construction.

### Exceptions:

1. Combustible construction shall be permitted where connected buildings are of combustible construction.
2. Fire-retardant-treated wood, in accordance with Section 603.1, Item 1.3, shall be permitted for the roof construction of the pedestrian walkway where connected buildings are a minimum of Type I or II construction.

**3104.4 Contents.** Only materials and decorations approved by the building official shall be located in the pedestrian walkway.

**3104.5 Fire barriers between pedestrian walkways and buildings.** Walkways shall be separated from the interior of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. This protection shall extend vertically from a point 10 feet (3048 mm) above the walkway roof surface or the connected building roof line, whichever is lower, down to a point 10 feet (3048 mm) below the walkway and horizontally 10 feet (3048 mm) from each side of the pedestrian walkway. Openings within the 10-foot (3048 mm) horizontal extension of the protected walls beyond the walkway shall be equipped with devices providing a  $\frac{3}{4}$ -hour fire protection rating in accordance with Section 715.

**Exception:** The walls separating the pedestrian walkway from a connected building and the openings within the 10-foot (3048 mm) horizontal extension of the protected walls beyond the walkway are not required to have a fire-resistance rating by this section where any of the following conditions exist:

1. The distance between the connected buildings is more than 10 feet (3048 mm). The pedestrian walkway and connected buildings, except for open parking garages, are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The wall is capable of resisting the passage of smoke or is constructed of a tempered, wired or laminated glass wall and doors subject to the following:
  - 1.1. The wall or glass separating the interior of the building from the pedestrian walkway shall be protected by an automatic sprinkler system in accordance with Section 903.3.1.1 and the sprinkler system shall completely wet the entire surface of interior sides of the wall or glass when actuated;
  - 1.2. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates; and
  - 1.3. Obstructions shall not be installed between the sprinkler heads and the wall or glass.
2. The distance between the connected buildings is more than 10 feet (3048 mm) and both sidewalls of the pedestrian walkway are not less than 50 percent open with the open area uniformly distributed to prevent the accumulation of smoke and toxic gases.
3. Buildings are on the same lot in accordance with Section 503.1.2.
4. Where exterior walls of connected buildings are required by Section 705 to have a fire-resistance rating greater than 2 hours, the walkway shall be equipped throughout with an automatic sprinkler

system installed in accordance with Section 903.3.1.1.

The previous exception shall apply to pedestrian walkways having a maximum height above grade of three stories or 40 feet (12 192 mm), or five stories or 55 feet (16 764 mm) where sprinklered.

**3104.6 Public way.** Pedestrian walkways over a public way shall comply with Chapter 32.

**3104.7 Egress.** Access shall be provided at all times to a pedestrian walkway that serves as a required exit.

**3104.8 Width.** The unobstructed width of pedestrian walkways shall be not less than 36 inches (914 mm). The total width shall be not greater than 30 feet (9144 mm).

**3104.9 Exit access travel.** The length of exit access travel shall be 200 feet (60 960 mm) or less.

#### Exceptions:

1. Exit access travel distance on a pedestrian walkway equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be 250 feet (76 200 mm) or less.
2. Exit access travel distance on a pedestrian walkway constructed with both sides not less than 50 percent open shall be 300 feet (91 440 mm) or less..
3. Exit access travel distance on a pedestrian walkway constructed with both sides not less than 50 percent open, and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, shall be 400 feet (122 m) or less.

**3104.10 Tunneled walkway.** Separation between the tunneled walkway and the building to which it is connected shall be not less than 2-hour fire-resistant construction and openings therein shall be protected in accordance with Table 716.5.

## SECTION 3105 AWNINGS AND CANOPIES

**3105.1 General.** Awnings or canopies shall comply with the requirements of Sections 3105.2 through 3105.4 and other applicable sections of this code.

**3105.2 Definition.** The following term is defined in Chapter 2:

#### RETRACTABLE AWNING.

**3105.3 Design and construction.** Awnings and canopies shall be designed and constructed to withstand wind or other lateral loads and live loads as required by Chapter 16 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. Awnings shall have frames of noncombustible material, fire-retardant-treated wood, wood of Type IV size, or 1-hour construction with combustible or noncombustible covers and shall be either fixed, retractable, folding or collapsible.

**3105.4 Canopy materials.** Canopies shall be constructed of a rigid framework with an approved covering that meets the

fire propagation performance criteria of NFPA 701 or has a flame spread index not greater than 25 when tested in accordance with ASTM E 84 or UL 723. *All fabrics and all interior decorative fabrics or materials shall be flame resistant in accordance with appropriate standards set forth in CCR, Title 19, Division 1, Chapter 8. Tops and sidewalls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).*

## **SECTION 3106 MARQUEES**

**3106.1 General.** Marquees shall comply with Section 3106.2 through 3106.5 and other applicable sections of this code.

**3106.2 Thickness.** The height or thickness of a marquee measured vertically from its lowest to its highest point shall be not greater than 3 feet (914 mm) where the marquee projects more than two-thirds of the distance from the lot line to the curb line, and shall be not greater than 9 feet (2743 mm) where the marquee is less than two-thirds of the distance from the lot line to the curb line.

**3106.3 Roof construction.** Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of Chapter 24. Every roof and skylight of a marquee shall be sloped to downspouts that shall conduct any drainage from the marquee in such a manner so as not to spill over the sidewalk.

**3106.4 Location prohibited.** Every marquee shall be so located as not to interfere with the operation of any exterior standpipe, and such that the marquee does not obstruct the clear passage of stairways or exit discharge from the building or the installation or maintenance of street lighting.

**3106.5 Construction.** A marquee shall be supported entirely from the building and constructed of noncombustible materials. Marquees shall be designed as required in Chapter 16. Structural members shall be protected to prevent deterioration.

## **SECTION 3107 SIGNS**

**3107.1 General.** Signs shall be designed, constructed and maintained in accordance with this code.

## **SECTION 3108 TELECOMMUNICATION AND BROADCAST TOWERS**

**3108.1 General.** Towers shall be designed and constructed in accordance with the provisions of TIA-222. Towers shall be designed for seismic loads; exceptions related to seismic design listed in Section 2.7.3 of TIA-222 shall not apply. In Section 2.6.6.2 of TIA 222, the horizontal extent of Topographic Category 2, escarpments, shall be 16 times the height of the escarpment.

**Exception:** Single free-standing poles used to support antennas not greater than 75 feet (22 860 mm), measured from the top of the pole to grade, shall not be required to be noncombustible.

**3108.2 Location and access.** Towers shall be located such that guy wires and other accessories shall not cross or encroach upon any street or other public space, or over above-ground electric utility lines, or encroach upon any privately owned property without the written consent of the owner of the encroached-upon property, space or above-ground electric utility lines. Towers shall be equipped with climbing and working facilities in compliance with TIA-222. Access to the tower sites shall be limited as required by applicable OSHA, FCC and EPA regulations.

## **SECTION 3109 SWIMMING POOL ENCLOSURES AND SAFETY DEVICES**

**3109.1 General.** Swimming pools shall comply with the requirements of Sections 3109.2 through 3109.5 and other applicable sections of this code.

**3109.2 Definition.** The following terms are defined in Chapter 2:

**ANSI/APSP PERFORMANCE STANDARD.**

**APPROVED SAFETY POOL COVER.**

**ENCLOSURE.**

**EXIT ALARMS.**

**PUBLIC SWIMMING POOL.**

**SUCTION OUTLET.**

**SWIMMING POOL or POOL.**

**SWIMMING POOLS.**

**3109.3 Public swimming pools.** Public swimming pools shall be completely enclosed by a fence not less than 4 feet (1290 mm) in height or a screen enclosure. Openings in the fence shall not permit the passage of a 4-inch-diameter (102 mm) sphere. The fence or screen enclosure shall be equipped with self-closing and self-latching gates.

**3109.4 Residential swimming pools.** Residential swimming pools shall comply with Sections 3109.4.1 through 3109.4.3.

**Exception:** A swimming pool with a power safety cover or a spa with a safety cover complying with ASTM F 1346 need not comply with Section 3109.4.

**3109.4.1 Barrier height and clearances.** The top of the barrier shall be not less than 48 inches (1219 mm) above grade measured on the side of the barrier that faces away from the swimming pool. The vertical clearance between grade and the bottom of the barrier shall be not greater than 2 inches (51 mm) measured on the side of the barrier that faces away from the swimming pool. Where the top of the pool structure is above grade, the barrier is authorized to be at ground level or mounted on top of the pool structure, and the vertical clearance between the top of the pool structure and the bottom of the barrier shall be not greater than 4 inches (102 mm).

**3109.4.1.1 Openings.** Openings in the barrier shall not allow passage of a 4-inch-diameter (102 mm) sphere.

**3109.4.1.2 Solid barrier surfaces.** Solid barriers which do not have openings shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.

**3109.4.1.3 Closely spaced horizontal members.** Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall be not greater than  $1\frac{3}{4}$  inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall be not greater than  $1\frac{3}{4}$  inches (44 mm) in width.

**3109.4.1.4 Widely spaced horizontal members.** Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall be not greater than 4 inches (102 mm). Where there are decorative cutouts within vertical members, spacing within the cutouts shall be not greater than  $1\frac{3}{4}$  inches (44 mm) in width.

**3109.4.1.5 Chain link dimensions.** Mesh size for chain link fences shall be not greater than a  $2\frac{1}{4}$  inch square (57 mm square) unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to not more than  $1\frac{3}{4}$  inches (44 mm).

**3109.4.1.6 Diagonal members.** Where the barrier is composed of diagonal members, the opening formed by the diagonal members shall be not greater than  $1\frac{3}{4}$  inches (44 mm).

**3109.4.1.7 Gates.** Access doors or gates shall comply with the requirements of Sections 3109.4.1.1 through 3109.4.1.6 and shall be equipped to accommodate a locking device. Pedestrian access doors or gates shall open outward away from the pool and shall be self-closing and have a self-latching device. Doors or gates other than pedestrian access doors or gates shall have a self-latching device. Release mechanisms shall be in accordance with Sections 1008.1.9 and 1109.13. Where the release mechanism of the self-latching device is located less than 54 inches (1372 mm) from the bottom of the door or gate, the release mechanism shall be located on the pool side of the door or gate 3 inches (76 mm) or more, below the top of the door or gate, and the door or gate and barrier shall be without openings greater than  $\frac{1}{2}$  inch (12.7 mm) within 18 inches (457 mm) of the release mechanism.

**3109.4.1.8 Dwelling wall as a barrier.** Where a wall of a dwelling serves as part of the barrier, one of the following shall apply:

1. Doors with direct access to the pool through that wall shall be equipped with an alarm that pro-

duces an audible warning when the door and/or its screen, if present, are opened. The alarm shall be listed and labeled in accordance with UL 2017. In dwellings not required to be Accessible units, Type A units or Type B units, the deactivation switch shall be located 54 inches (1372 mm) or more above the threshold of the door. In dwellings required to be Accessible units, Type A units or Type B units, the deactivation switch shall be located not higher than 54 inches (1372 mm) and not less than 48 inches (1219 mm) above the threshold of the door.

2. The pool shall be equipped with a power safety cover that complies with ASTM F 1346.
3. Other means of protection, such as self-closing doors with self-latching devices, which are approved, shall be accepted so long as the degree of protection afforded is not less than the protection afforded by Section 3109.4.1.8, Item 1 or 2.

**3109.4.1.9 Pool structure as barrier.** Where an aboveground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps, then the ladder or steps either shall be capable of being secured, locked or removed to prevent access, or the ladder or steps shall be surrounded by a barrier which meets the requirements of Sections 3109.4.1.1 through 3109.4.1.8. Where the ladder or steps are secured, locked or removed, any opening created shall not allow the passage of a 4-inch-diameter (102 mm) sphere.

**3109.4.2 Indoor swimming pools.** Walls surrounding indoor swimming pools shall not be required to comply with Section 3109.4.1.8.

**3109.4.3 Prohibited locations.** Barriers shall be located so as to prohibit permanent structures, equipment or similar objects from being used to climb the barriers.

**3109.4.4 Private swimming pools (statewide).** *These regulations are subject to local government modification. The applicable local government requirements at the time of application for a building permit should be verified. These standards become applicable commencing January 1, 1998, to a private, single-family home for which a construction permit for a new swimming pool has been issued on or after January 1, 1998.*

**3109.4.4.1 Definitions.** As used in this division, the following terms have the following meanings:

**ANSI/APSP PERFORMANCE STANDARD** means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).

**APPROVED SAFETY POOL COVER** means a manually or power-operated safety pool cover that meets all of the performance standards of the American Society for Testing and Materials (ASTM), in compliance with Standard F 1346-91.

**ENCLOSURE** means a fence, wall or other barrier that isolates a swimming pool from access to the home.

**EXIT ALARMS** means devices that make audible, continuous alarm sounds when any door or window that permits access from the residence to the pool area, that is without any intervening enclosure, is opened or is left ajar. Exit alarms may be battery operated or may be connected to the electrical wiring of the building.

**PUBLIC SWIMMING POOL** means a swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club. Public swimming pool does not include a swimming pool located on the grounds of a private single-family home.

**SUCTION OUTLET** means a fitting or fixture typically located at the bottom or on the sides of a swimming pool that conducts water to a recirculating pump.

**SWIMMING POOL** or **POOL** means any structure intended for swimming or recreational bathing that contains water over 18 inches (457 mm) deep. Swimming pool includes in-ground and above-ground structures and includes, but is not limited to, hot tubs, spas, portable spas and nonportable wading pools.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115921  
Ab 3305, Statutes 1996, c.925

**3109.4.4.2 Construction permit; safety features required.** Commencing January 1, 2007, except as provided in Section 3109.4.4.5, whenever a building permit is issued for construction of a new swimming pool or spa, or any building permit is issued for remodeling of an existing pool or spa, at a private, single-family home, it shall be equipped with at least one of the following seven drowning prevention safety features:

1. The pool shall be isolated from access to a home by an enclosure that meets the requirements of Section 3109.4.4.3.
2. The pool shall incorporate removable mesh pool fencing that meets American Society for Testing and Materials (ASTM) Specifications F 2286 standards in conjunction with a gate that is self-closing and self-latching and can accommodate a key lockable device.
3. The pool shall be equipped with an approved safety pool cover that meets all requirements of the ASTM Specifications F 1346.
4. The residence shall be equipped with exit alarms on those doors providing direct access to the pool.
5. All doors providing direct access from the home to the swimming pool shall be equipped with a self-closing, self-latching device with a release mechanism placed no lower than 54 inches (1372 mm) above the floor.
6. Swimming pool alarms that, when placed in pools, will sound upon detection of accidental or unauthorized entrance into the water. These pool alarms shall meet and be independently certified

to the ASTM Standard F 2208 "Standards Specification for Pool Alarms" which includes surface motion, pressure, sonar, laser and infrared type alarms. For purposes of this article, "swimming pool alarms" shall not include swimming protection alarm devices designed for individual use, such as an alarm attached to a child that sounds when the child exceeds a certain distance or becomes submerged in water.

7. Other means of protection, if the degree of protection afforded is equal to or greater than that afforded by any of the devices set forth in items 1-4, and have been independently verified by an approved testing laboratory as meeting standards for those devices established by the ASTM or the American Society of Testing Mechanical Engineers (ASME).

Prior to the issuance of any final approval for the completion of permitted construction or remodeling work, the local building code official shall inspect the drowning safety prevention devices required by this act and if no violations are found, shall give final approval.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115922

AB 3305 (Statutes 1996, c.925); AB 2977 (Statutes 2006, c.478); AB 382 (Statutes 2007, c.596)

**3109.4.4.3 Enclosure; required characteristics.** An enclosure shall have all of the following characteristics:

1. Any access gates through the enclosure open away from the swimming pool and are self-closing with a self-latching device placed no lower than 60 inches (1524 mm) above the ground.
2. A minimum height of 60 inches (1524 mm).
3. A maximum vertical clearance from the ground to the bottom of the enclosure of 2 inches (51 mm).
4. Gaps or voids, if any, do not allow passage of a sphere equal to or greater than 4 inches (102 mm) in diameter.
5. An outside surface free of protrusions, cavities or other physical characteristics that would serve as handholds or footholds that could enable a child below the age of five years to climb over.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115923

AB 3305, Statutes 1996, c.925

**3109.4.4.4 Agreements to build; notice of provisions.**

Any person entering into an agreement to build a swimming pool or spa, or to engage in permitted work on a pool or spa covered by this article, shall give the consumer notice of the requirements of this article.

Pursuant to existing law, the Department of Health Services shall have available on the department's web site, commencing January 1, 2007, approved pool safety information available for consumers to down-

load. Pool contractors are encouraged to share this information with consumers regarding the potential dangers a pool or spa poses toddlers. Additionally, pool contractors may provide the consumer with swimming pool safety materials produced from organizations such as the United States Consumer Product Safety Commission, Drowning Prevention Foundation, California Coalition for Children's Safety & Health, Safe Kids Worldwide, Association of Pool and Spa Professionals, or the American Academy of Pediatrics.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115924

AB 3305 (Statutes 1996, c.925); AB 2977 (Statutes 2006, c.478); AB 382 (Statutes 2007, c.596)

**3109.4.4.5 Exempt facilities.** The requirements of this article shall not apply to any of the following:

1. Public swimming pools.
2. Hot tubs or spas with locking safety covers that comply with the American Society for Testing Materials Emergency Performance Specification (ASTM ES 13-89).
3. Any pool within the jurisdiction of any political subdivision that adopts an ordinance for swimming pool safety that includes requirements that are at least as stringent as this division.
4. An apartment complex or any residential setting other than a single-family home.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115925

Ab 3305, (Statutes 1996, c.925); AB 2977 (Statutes 2006, c.478); AB 382 (Statutes 2007,c.596)

**3109.4.4.6 Application to facilities regulated by Department of Social Services.** This division does not apply to any facility regulated by the State Department of Social Services even if the facility is also used as a private residence of the operator. Pool safety in those facilities shall be regulated pursuant to regulations adopted therefor by the State Department of Social Services.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115926

Ab 3305, Statutes 1996, c.925); AB 2977 (Statutes 2006, c.478); AB 382 (Statutes 2007, c.596)

**3109.4.4.7 Modification and interpretation of division.** Notwithstanding any other provision of law, this article shall not be subject to further modification or interpretation by any regulatory agency of the state, this authority being reserved exclusively to local jurisdictions, as provided for in Item 5 of Section 3109.4.4.2 and Item 3 of Section 3109.4.4.5.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115927

AB 3305 (Statutes 1996, c.925); AB 2977 (Statutes 2006, c.478); AB 382 (Statutes 2007, c.596)

**3109.4.4.8 Construction requirements for building a pool or spa.** Whenever a building permit is issued for the construction a new swimming pool or spa, the pool or spa shall meet all of the following requirements:

1. The suction outlets of the pool or spa for which the permit is issued shall be equipped to provide circulation throughout the pool or spa as prescribed in Paragraphs 2 and 3.
2. The swimming pool or spa shall either have at least two circulation suction outlets per pump that shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets, or be designed to use alternatives to suction outlets including, but not limited to, skimmers or perimeter overflow systems to conduct water to the recirculation pump.
3. The circulation system shall have the capacity to provide a complete turnover of pool water, as specified in Section 3124B of Chapter 31B of the California Building Standards Code (Title 24 of the California Code of Regulations).
4. Suction outlets shall be covered with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or successor standard designated by the federal Consumer Product Safety Commission, that cannot be removed except with the use of tools. Slots of openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.
5. Any backup safety system that an owner of a new swimming pool or spa may choose to install in addition to the requirements set forth in subdivisions (1) through (4) above shall meet the standards as published in the document, "Guidelines for Entrapment Hazards: Making Pools and Spas Safer," Publication Number 363, March 2005, United States Consumer Products Safety Commission.
6. Whenever a building permit is for the remodel or modification of any existing swimming pool, toddler pool, or spa, the permit shall require that the suction outlet or suction outlets of the existing swimming pool, toddler pool, or spa be upgraded so as to be equipped with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or a successor standard designated by the federal Consumer Product Safety Commission.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 115928 AB

3305 (Statutes 1996, c.925); AB 2977 (Statutes 2006, c.478); AB 478 (Statutes 2007, c.596)

**3109.5 Entrapment avoidance.** Suction outlets shall be designed and installed in accordance with ANSI/APSP-7.

**3109.6 Informative documents.**

1. The Legislature encourages a private entity, in consultation with the Epidemiology and Prevention for Injury Control Branch of the department, to produce an informative brochure or booklet, for consumer use, explaining the child drowning hazards of, possible safety measures for, and appropriate drowning hazard prevention measures for, home swimming pools and spas, and to donate the document to the department.
2. The Legislature encourages the private entity to use existing documents from the United States Consumer Product Safety Commission on pool safety.
3. If a private entity produces the document described in Subdivisions 1 and 2 and donates it to the department, the department shall review and approve the brochure or booklet.
4. Upon approval of the document by the department, the document shall become the property of the state and a part of the public domain. The department shall place the document on its Web site in a format that is readily available for downloading and for publication. The department shall review the document in a timely and prudent fashion and shall complete the review within 18 months of receipt of the document from a private entity.

## SECTION 3110 AUTOMATIC VEHICULAR GATES

**3110.1 General.** Automatic vehicular gates shall comply with the requirements of Sections 3110.2 through 3110.4 and other applicable sections of this code.

**3110.2 Definition.** The following term is defined in Chapter 2:

**VEHICULAR GATE.**

**3110.3 Vehicular gates intended for automation.** Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F 2200.

**3110.4 Vehicular gate openers.** Vehicular gate openers, where provided, shall be listed in accordance with UL 325.

## SECTION 3111 SOLAR PHOTOVOLTAIC PANELS/MODULES

**3111.1 Solar photovoltaic power systems.** Solar photovoltaic power systems shall be installed in accordance with Sections 3111.2 through 3111.5 and the California Electrical Code.

**Exception:** Detached, nonhabitable Group U structures including, but not limited to, parking shade structures, carports, solar trellises and similar structures shall not be subject to the requirements of this section.

**3111.2 Marking.** Marking is required on interior and exterior direct-current (DC) conduit, enclosures, raceways, cable assemblies, junction boxes, combiner boxes and disconnects.

**3111.2.1 Materials.** The materials used for marking shall be reflective, weather resistant and suitable for the environment. Marking as required in Sections 3111.2.2 through 3111.2.4 shall have all letters capitalized with a minimum height of  $\frac{3}{8}$  inch (9.5 mm) white on red background.

**3111.2.2 Marking content.** The marking shall contain the words "WARNING: PHOTOVOLTAIC POWER SOURCE."

**3111.2.3 Main service disconnect.** The marking shall be placed adjacent to the main service disconnect in a location clearly visible from the location where the disconnect is operated.

**3111.2.4 Location of marking.** Marking shall be placed on interior and exterior DC conduit, raceways, enclosures and cable assemblies every 10 feet (3048 mm), within 1 foot (305 mm) of turns or bends and within 1 foot (305 mm) above and below penetrations of roof/ceiling assemblies, walls or barriers.

**3111.3 Locations of DC conductors.** Conduit, wiring systems and raceways for photovoltaic circuits shall be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between subarrays and to DC combiner boxes shall be installed in a manner that minimizes the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays. DC wiring shall be installed in metallic conduit or raceways when located within enclosed spaces in a building. Conduit shall run along the bottom of load bearing members.

**3111.4 Access and pathways.** Roof access, pathways and spacing requirements shall be provided in accordance with Sections 3111.4.1 through 3111.4.3.3.

**Exceptions:**

1. Residential structures shall be designed so that each photovoltaic array is no greater than 150 feet (45 720 mm) by 150 feet (45 720 mm) in either axis.
2. Panels/modules shall be permitted to be located up to the roof ridge where an alternative ventilation method approved by the fire chief has been provided or where the fire chief has determined vertical ventilation techniques will not be employed.

**3111.4.1 Roof access points.** Roof access points shall be located in areas that do not require the placement of ground ladders over openings such as windows or doors, and located at strong points of building construction in locations where the access point does not conflict with overhead obstructions such as tree limbs, wires or signs.

**3111.4.2 Residential systems for one- and two-family dwellings.** Access to residential systems for one- and two-

family dwellings shall be provided in accordance with Sections 3111.4.2.1 through 3111.4.2.4.

**3111.4.2.1 Residential buildings with hip roof layouts.** Panels/modules installed on residential buildings with hip roof layouts shall be located in a manner that provides a 3-foot-wide (914 mm) clear access pathway from the eave to the ridge on each roof slope where panels/modules are located. The access pathway shall be located at a structurally strong location on the building capable of supporting the live load of fire fighters accessing the roof.

**Exception:** These requirements shall not apply to roofs with slopes of two units vertical in 12 units horizontal (2:12) or less.

**3111.4.2.2 Residential buildings with a single ridge.** Panels/modules installed on residential buildings with a single ridge shall be located in a manner that provides two, 3-foot-wide (914 mm) access pathways from the eave to the ridge on each roof slope where panels/modules are located.

**Exception:** This requirement shall not apply to roofs with slopes of two units vertical in 12 units horizontal (2:12) or less.

**3111.4.2.3 Residential buildings with roof hips and valleys.** Panels/modules installed on residential buildings with roof hips and valleys shall be located no closer than 18 inches (457 mm) to a hip or a valley where panels/modules are to be placed on both sides of a hip or valley. Where panels are to be located on only one side of a hip or valley that is of equal length, the panels shall be permitted to be placed directly adjacent to the hip or valley.

**Exception:** These requirements shall not apply to roofs with slopes of two units vertical in 12 units horizontal (2:12) or less.

**3111.4.2.4 Residential building smoke ventilation.** Panels/modules installed on residential buildings shall be located no higher than 3 feet (914 mm) below the ridge in order to allow for fire department smoke ventilation operations.

**3111.4.3 Other than residential buildings.** Access to systems for occupancies other than one- and two-family dwellings shall be provided in accordance with Sections 3111.4.3.1 through 3111.4.3.3.

**Exception:** Where it is determined by the fire code official that the roof configuration is similar to that of a one- or two-family dwelling, the residential access and ventilation requirements in Sections 3111.4.2.1 through 3111.4.2.4 shall be permitted to be used.

**3111.4.3.1 Access.** There shall be a minimum 6-foot-wide (1829 mm) clear perimeter around the edges of the roof.

**Exception:** Where either axis of the building is 250 feet (76 200 mm) or less, there shall be a minimum

4-foot-wide (1290 mm) clear perimeter around the edges of the roof.

**3111.4.3.2 Pathways.** The solar installation shall be designed to provide designated pathways. The pathways shall meet the following requirements:

1. The pathway shall be over areas capable of supporting the live load of fire fighters accessing the roof.
2. The centerline axis pathways shall be provided in both axes of the roof. Centerline axis pathways shall run where the roof structure is capable of supporting the live load of fire fighters accessing the roof.
3. Shall be a straight line not less than 4 feet (1290 mm) clear to skylights or ventilation hatches.
4. Shall be a straight line not less than 4 feet (1290 mm) clear to roof standpipes.
5. Shall provide not less than 4 feet (1290 mm) clear around roof access hatch with at least one not less than 4 feet (1290 mm) clear pathway to parapet or roof edge.

**3111.4.3.3 Smoke ventilation.** The solar installation shall be designed to meet the following requirements:

1. Arrays shall be no greater than 150 feet (45 720 mm) by 150 feet (45 720 mm) in distance in either axis in order to create opportunities for fire department smoke ventilation operations.
2. Smoke ventilation options between array sections shall be one of the following:
  - 2.1. A pathway 8 feet (2438 mm) or greater in width.
  - 2.2. A 4-foot (1290 mm) or greater in width pathway and bordering roof skylights or smoke and heat vents.
  - 2.3. A 4-foot (1290 mm) or greater in width pathway and bordering 4-foot by 8-foot (1290 mm by 2438 mm) "venting cutouts" every 20 feet (6096 mm) on alternating sides of the pathway.

**3111.5 Ground-mounted photovoltaic arrays.** Ground-mounted photovoltaic arrays shall comply with Sections 3111.1 through 3111.3 and this section. Setback requirements shall not apply to ground-mounted, free-standing photovoltaic arrays. A clear, brush-free area of 10 feet (3048 mm) shall be required for ground-mounted photovoltaic arrays.





**CHAPTER 31A**  
**SYSTEMS FOR WINDOW CLEANING OR**  
**EXTERIOR BUILDING MAINTENANCE**

*See Title 8, California Code of Regulations, Division 1, Chapter 4, Subchapter 7,  
General Industry Safety Orders, Group 1, Articles 5 and 6.*



## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 31B – PUBLIC SWIMMING POOLS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter														X						
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below						X														
Chapter/Section																				
3114B.1 w/Exception 2 only						X														



## CHAPTER 31B [DPH]

# PUBLIC POOLS

### Division I—GENERAL

#### SECTION 3101B SCOPE

The provisions of this chapter shall apply to the construction, installation, renovation, alteration, addition, relocation, replacement or use of any public pool and to its ancillary facilities, mechanical equipment and related piping. Public pools include those located in or designated as the following: commercial building, hotel, motel, resort, recreational vehicle or mobile home park, campground, apartment house, condominium, townhouse, homeowner association, club, community building or area, public or private school, health club or establishment, water park, swim school, medical facility, bed and breakfast, licensed day-care facility, recreation and park district and municipal pools.

#### SECTION 3102B DEFINITIONS

**ANCILLARY FACILITY** is any area used in conjunction with or for the operation of a pool such as public dressing rooms, lockers, shower or bathroom areas, drinking fountains, equipment room, pool deck area, pool enclosure or building space that is intended to be used by pool users.

**BACKWASH** is the process of reversing the flow of water through the filter to thoroughly clean the filter media and/or elements and remove the debris from the contents of the filter vessel.

**CANTILEVERED DECKING** is the part of the deck which extends over a top edge of a pool or spa.

**CLEAN POOL WATER** is pool water that is free of dirt, oils, scum, algae, floating materials or visible organic and inorganic materials that would pollute the water.

**CLEAR POOL WATER** is pool water that is free from cloudiness and is transparent.

**COPING** is a slip-resistant cap installed on the top edge of a pool or spa.

**CORROSION RESISTANT** is capable of maintaining original surface characteristics under the prolonged influence of the use environment.

**DECK** is an area surrounding a pool which is specifically constructed or installed for use by pool users.

**DIATOMACEOUS EARTH** is a filtering media consisting of microscopic fossilized skeletons of diatoms.

**EASILY CLEANABLE** is a characteristic of a surface or material that allows removal of dirt, stains or residue by normal cleaning methods.

**EFFECTIVE PARTICLE SIZE** is the theoretical size of a sieve in mm that will pass 10 percent by weight of sand.

**ENFORCING AGENT** is the health officer, director of environmental health, registered environmental health specialist or environmental health specialist trainee.

**EQUIPMENT AREA** is an area where the recirculation system and all related appurtenances are located.

**HANDHOLD** is a structure located at or above the water line around the perimeter of the pool wall that allows a pool user to hold onto the poolside for support.

**INLET** is a fitting or fixture through which recirculated water enters the pool.

**LADDER** is a series of vertically separate treads or rungs either connected by vertical rail members or independently fastened to an adjacent vertical pool wall.

**LIVING UNIT** is any building or portion thereof that contains living facilities including provisions for sleeping.

**MAIN DRAIN** is a submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump.

**MEDICAL POOL** is a special-purpose pool used by a State-recognized medical institution engaged in the healing arts under the direct supervision of licensed medical personnel for treatment of the infirm.

**OUTLET** is a fitting or fixture through which recirculated water is removed from the pool which may or may not be connected to the pump.

**PERFORMANCE STANDARD** is a standard that is accredited and published. Products compliant with a standard may be listed by any authorized nationally recognized testing laboratory.

**PERIMETER OVERFLOW SYSTEM** is a system which includes perimeter-type overflow gutters, surge basin or similar surface water collective system components and their interconnecting piping.

**PERMISSIBLE EXPOSURE LIMIT** is the maximum amount or concentration of a chemical that a worker may be exposed to under United States Occupational Safety and Health Administration regulations.

**POOL OR PUBLIC POOL** is an artificial basin, chamber or tank constructed or prefabricated with impermeable surfaces that is used, or intended to be used, for public swimming, diving or recreational activities but does not include individual therapeutic tubs or baths where the main purpose is the cleaning of the body. Any manmade lake or swimming lagoon with a sand beach or sand bottom is not a public pool.

**POOL OPERATOR or OPERATOR** is a person who is responsible for maintaining compliance with all requirements

relating to pool operation, maintenance and safety of pool users.

**POOL USER** is a person using a pool and ancillary facilities for the purpose of water activities such as diving, swimming or wading.

**RADIUS OF CURVATURE** is the radius arc which denotes the curved surface from the point of departure from the springline of the pool to the pool bottom.

**READILY ACCESSIBLE** is capable of being reached easily for cleaning, repair, replacement or inspection without the necessity of removing a panel, door or similar obstruction and without requiring a person to climb over or remove obstacles or to use devices such as portable ladders.

**READILY DISASSEMBLED** means capable of being taken apart by hand or by using only simple tools such as a screwdriver, pliers or open-end wrench.

**RECESSED STEPS** are a series of vertically spaced cavities in the pool wall creating riser and tread areas for pool ingress and egress.

**RECIRCULATION SYSTEM** is the system of hydraulic components designed to remove, filter, disinfect and return water to the pool.

**RIM FLOW GUTTER** is a perimeter overflow system in which the overflow rim is at the same elevation with the deck.

**SKIMMER EQUALIZER LINE** is a submerged suction outlet located below the waterline and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir or the skimmer is blocked by debris. A skimmer equalizer line is not a main drain.

**SLIP RESISTANT** is a rough finish that is not abrasive to the bare foot.

**SPA POOL OR SPA** is a pool that incorporates a water jet system, an aeration system or a combination of the two systems used in conjunction with heated water.

**SPECIAL PURPOSE POOL** is a pool constructed exclusively for a specific purpose, such as instruction, diving, competition or medical treatment.

**SPLASH ZONE** is the maximum distance the water from a spray ground can project horizontally.

**SPRAY GROUND** is a pool with no standing water in the splash zone and consists of a surge basin with a recirculation system from which water is directed through water features for contact with pool users.

**SPRINGLINE** is the point from which the pool wall breaks from vertical and begins its arc in the radius of curvature.

**STAIRS** are a series of two or more steps.

**STEP** is a riser and tread.

**SUCTION OUTLET** is any outlet that is connected to the pump through which water is removed from the pool.

**SURGE BASIN** is a reservoir or surge trench open to the atmosphere that receives water via gravity flow from the main drain, spray ground or perimeter overflow system and from which the recirculation system operates.

**TEMPERED WATER** is water between 100°F and 110°F.

**TURNOVER TIME** is the maximum time allowed to circulate one complete volume of the pool water through the recirculation system.

**UNIFORMITY COEFFICIENT** is the ratio of the theoretical size of a sieve in mm that will pass 60 percent of the sand to the theoretical size of a sieve in mm that will pass 10 percent of the sand.

**WADING POOL** is a pool intended to be used for wading by small children and having a maximum water depth of 18 inches (457 mm) at the deepest point.

**WATER FEATURE** means an interactive device or structure through which water is directed to the pool user such as a water fountain, water spray, dancing water jet, waterfall, dumping bucket or shooting water cannon.

**WATERLINE** shall be defined as one of the following:

1. **Skimmer system.** The waterline shall be the midpoint of the operating range of the skimmers.
2. **Overflow system.** The waterline shall be the top edge of the overflow rim.

## PLAN REVIEW, PERMITS, CONSTRUCTION AND FIELD INSPECTIONS

### SECTION 3103B PLAN REVIEW

**3103B.1** A person proposing to construct, renovate or alter a pool, ancillary facilities or equipment and appurtenances shall submit plans and specifications detailing compliance with this chapter to the enforcing agent for review and written approval prior to commencing construction and shall first be cleared by the enforcing agent before substitution if not an exact duplicate of the units being changed or replaced. A local building department shall not issue a permit for a public pool or ancillary facility until the plans have been approved by the enforcing agent.

**3103B.2** Plans submitted for approval pursuant to this section shall be drawn to a scale of  $\frac{1}{4}$  inch (6.4 mm) equals 1 foot (305 mm), except that plans for spa pools shall be drawn to a scale of 1 inch (25 mm) equals 1 foot (305 mm), unless otherwise approved by the enforcing agent.

**3103B.3** The enforcing agent shall notify the person submitting the plans and specifications of approval or disapproval.

**3103B.4** The enforcing agent shall retain one copy of the approved plans and specifications and any subsequent changes or modifications. The approved plans shall be valid for a period of two years from the date of approval or as extended by the enforcing agent.

## SECTION 3104B CONSTRUCTION

*Pools and all ancillary facilities, equipment and appurtenances shall be constructed, renovated or altered in compliance with plans approved pursuant to Section 3103B.*

## SECTION 3105B PLAN COMPLIANCE INSPECTIONS

**3105B** *The pool owner, operator or designated agent shall notify the enforcing agent prior to scheduling the following inspections:*

1. *Exposed plumbing; and*
2. *Prior to applying pneumatically placed concrete; and*
3. *Prior to applying the final surface to the pool shell; and*
4. *At the completion of construction. No pool shall be opened to the public without the written approval of the enforcing agent.*

## POOL STRUCTURE

### SECTION 3106B SPECIAL REQUIREMENTS FOR SPRAY GROUNDS

**3106B** *Spray grounds. All applicable provisions of this chapter shall apply to a spray ground unless specifically addressed in this section.*

**3106B.1** *All parts of the spray ground shall be designed and constructed so that there are no safety hazards.*

**3106B.2** *Walking surface. A minimum 4-foot wide walking surface shall extend around the perimeter of the splash zone of a spray ground.*

**3106B.3** *The recirculation system shall be in operation at all times that the spray ground is open for use and shall have a minimum of four turnover cycles prior to opening for proper disinfection and filtration.*

**3106B.4** *There shall be no standing water within the splash zone.*

**3106B.5** *Nozzles that spray from the ground level shall be flush with the ground with openings no greater than 1/2 inch. Spray ground water features that extend above the ground must be clearly visible.*

**3106B.6** *The splash zone shall be sloped so that only water from the spray ground water feature flows back to the surge basin. Areas adjacent to the splash zone shall be sloped away from the spray ground to deck drains or other surface water disposal systems.*

**3106B.7** *All foggers and misters that produce finely atomized mists shall be supplied directly from a potable water source and not from the surge basin.*

**3106B.8** *When multiple pumps are used the control systems for the spray ground water feature pump and recirculation system pump shall be electrically interconnected so that when the recirculation pump is off the spray ground water feature pump also is off.*

**3106B.9** *The spray ground shall have a surge basin or treatment tank constructed of materials which are inert, corrosion resistant, nontoxic and watertight including materials such as concrete, fiberglass, high density polyethylene, stainless steel or other materials as approved by the enforcing agent which can withstand all anticipated loadings under full and empty conditions as determined by an engineer or architect who has experience working on public pools.*

**3106B.10** *The total volume of the surge basin shall be at least 4,000 gallons or a minimum of three times the gallons per minute flow rate of all the spray ground pumps and the recirculation pump combined, whichever is higher.*

**3106B.11** *The turnover time shall be one-half hour or less.*

**3106B.12** *The suction intake for the spray ground or water feature pump in the surge basin shall be located adjacent to the recirculation return line.*

**3106B.13** *When separate pumps are used, the suction intake for the recirculation pump shall be located in the lowest portion of the surge basin and on the opposite side from the suction intake for the spray ground pump.*

**3106B.14** *The surge basin shall be designed to have easy access for cleaning and inspection. The basin shall have at least one ladder access and shall have at least one 3-foot by 3-foot access opening. Lids shall be locked or require a tool to open.*

**3106B.15** *The surge basin shall be equipped with an automatic make up water fill device through an air gap or be protected by an approved backflow prevention device in accordance with Chapter 6 of the California Plumbing Code.*

**3106B.16** *Ultraviolet light disinfection shall be used to supplement disinfection methods required in this chapter unless another treatment process is provided that has been determined by a nationally recognized testing laboratory to be capable of providing at least the equivalent level of reduction of cryptosporidium as the ultraviolet light disinfection system specified in this section. The ultraviolet light disinfection unit shall comply with the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.*

**3106B.17** *An accurately calibrated ultraviolet light intensity meter that has been properly filtered to restrict its sensitivity to the disinfection spectrum shall be installed in the wall of the disinfection chamber at the point of greatest water depth from the light source.*

**3106B.18** *The ultraviolet light unit shall be located on the recirculation system and shall be installed to provide treated water directly to the spray features.*



**3106B.19** The ultraviolet light disinfection system must be equipped with an automatic shutdown system that inactivates the water feature pump if the ultraviolet dosage rate drops below 40 mJ/cm<sup>2</sup>.

**3106B.20** Artificial lighting shall be provided at all spray ground pads which are used at night or which do not have adequate natural lighting so that all portions of the spray pad and deck may be seen easily. Lighting that may be exposed to the feature pool water shall be installed in accordance with the manufacturer's specifications and the California Electrical Code.

**3106B.21** A diverter valve shall be installed on the spray ground drainage piping before the surge basin to divert water to the storm drainage system when the splash ground is not in operation.

**3106B.22** A removable and cleanable catch screen or basket shall be installed on the spray ground drainage system before it enters the reservoir to prevent larger debris from collecting in the surge basin.

### SECTION 3107B ALTERNATIVE EQUIPMENT, MATERIALS AND METHODS OF CONSTRUCTION

**3107B.1** The enforcing agent may approve an alternative equipment, material or method of construction provided it finds that the proposed design is satisfactory and complies with the provisions of this chapter, that the equipment, material, method or work offered is, for the purpose intended, at least equivalent to that prescribed in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation or that the methods of installation proposed conform to other acceptable nationally recognized standards.

**3107B.2** The enforcing agent shall require that sufficient evidence or proof be submitted to substantiate claims that may be made regarding the use of alternative equipment, material or method of construction.

**3107B.3** Whenever there is insufficient evidence of compliance with the provisions of this chapter, the enforcing agent may require tests as proof of compliance to be made at no expense to the enforcing agent. Tests shall be made in accordance with approved standards, but in the absence of such standards the enforcing agent may specify the test procedure.

### SECTION 3108B POOL CONSTRUCTION

**3108B.1 Pool shell.** The pool shall be built of reinforced concrete or material equivalent in strength, watertight and able to withstand anticipated stresses under both full and empty conditions taking into consideration factors such as climatic effects, geological conditions and integration of the pool with other structures.

**3108B.2 Finish.** The finished pool shell shall be lined with a smooth waterproof interior finish that will withstand repeated brushing, scrubbing and cleaning procedures. The interior pool finish shall completely line the pool to the tile lines, coping, or cantilevered deck.

**3108B.3 Finish color.** The finish color shall be white except for the following which shall be of contrasting color:

1. Lane and other required pool markings described in Section 3110B; and
2. The top surface edges of benches in spa pools; and
3. The edge of pool steps; and
4. Tiles installed at the waterline; and
5. Tiles installed at the 4½-foot (1372 mm) depth line.

**Exception:** A spa pool may be finished in a light color other than white when approved by the enforcing agent.

**3108B.4 Projections and recessed areas.** The pool shell shall not have projections or recessed areas except for pool inlets and outlets as specified in Section 3137B.

**Exception:** This section shall not apply to handholds, recessed steps, ladders, stairs, handrails, skimmers or perimeter overflow systems.

### SECTION 3109B POOL GEOMETRY

**3109B.1 General.** A pool shall conform to the appropriate criteria in Figures 31B-1 through 31B-7.

**Exception:** A special purpose pool may be exempted from construction standards that are not applicable to the proposed use.

**3109B.2 Dimensional tolerances.** A construction tolerance shall be permitted on all dimensions in Figures 31B-1 through 31B-3 not to exceed 2 inches (51 mm) except that the tolerance of the water level of a pool with a nonadjustable overflow system shall not exceed 1/8 inch (3.2 mm).

**3109B.3 Bottom slope break.** Any portion of a pool having a water depth of 4½ feet (1372 mm) or less shall have a uniform slope that shall not exceed 1 foot (305 mm) of vertical in 10 feet (3050 mm) of horizontal. In pools with water depths greater than 4½ feet (1372 mm) the slope shall meet the requirements in Figures 31B-1 through 31B-3. There shall be a uniform water depth along the entire base of the stairs.

## SECTION 3110B PERMANENT MARKINGS

**3110B.1 General.** No markings, designs or lettering shall be permitted on the pool shell except for slip resistant lane markings, depth marking lines and safety markings.

**3110B.2 Lane markings.** Slip resistant lane lines at the bottom of the pool shall not exceed 12 inches (305 mm) in width.

**3110B.3 Depth marking line.** There shall be installed a straight line of slip resistant tile a minimum of 4 inches (102 mm) and not greater than 6 inches (152 mm) wide of a color contrasting with the background of the pool shell across the bottom of the pool where the water depth is 4½ feet (1372 mm).

**Exception:** Pools having a maximum water depth of 5 feet (1524 mm) or less shall not be required to have a depth marking line.

### 3110B.4 Water depth markers.

**3110B.4.1 Location.** The water depth shall be clearly marked at the following locations:

1. Maximum depth; and
2. Minimum depth; and
3. Each end; and
4. Both sides at each end; and
5. At the break in the bottom slope between the shallow and deep portions of the pool (see also Section 3109B.3); and
6. Along the perimeter of the pool at distances not to exceed 25 feet (7620 mm).

**Exception:** A spa or wading pool shall have a minimum of two depth markers indicating the maximum depth.

**3110B.4.2 Position.** Where required by Section 3110B.4.1, depth markers shall be located in the following positions:

1. On the coping or on the deck, the depth markers shall be placed as close as possible but no more than 3 feet (914 mm) from the pool water; and
2. For pools with skimmer systems the depth markers shall be high at the waterline which typically will result in the depth markers being submerged approximately 50 percent; or
3. For pools with perimeter overflow systems where coping cantilevers over the gutter depth markers may be positioned at the face of the cantilevered coping, the back wall above the gutter or immediately below the waterline which will result in the depth markers being completely submerged; or
4. For pools with rim flow gutters, depth markers shall be positioned immediately below the waterline which will result in the depth markers being completely submerged.

**3110B.4.3 Tolerance.** Depth markers shall be positioned to indicate the water depth accurate to the nearest 6 inches (152 mm) as measured at the waterline.

### 3110B.4.4 Size of markers. Depth markers shall:

1. Have numerals a minimum of 4 inches (102 mm) in height and of a color contrasting with the background and be marked in units of feet and inches. Abbreviations of FT and IN may be used in lieu of feet and inches; and
2. Be made of a durable material that is resistant to weathering; and
3. Be slip resistant when they are located on the pool deck.

**3110B.5 No diving markers.** For pool water depths 6 feet (1830 mm) and shallower no diving markers with the universal symbol of no diving, which is a red circle with a slash through it superimposed over the image of a diver, shall be installed on the deck directly adjacent to the depth markers required by Section 3110B.4.1. No diving markers shall comply with Section 3110B.4.4(2-3).

## SECTION 3111B STEPS, RECESSED STEPS, LADDERS AND STAIRS

**3111B.1 Construction.** A means of entry and exit to and from the pool shall consist of steps, recessed steps, ladders, stairs, ramps or a combination of these. One means of entry and exit shall be provided in the shallowest portion of a pool if the vertical distance from the bottom of the pool to the deck is over 1 foot (305 mm). A second means of entry and exit shall be provided in the deep portion of a pool having a depth greater than 4½ feet (1372 mm). Where the width of the pool exceeds 30 feet (9144 mm), such means of entry and exit shall be provided at each side, not more than 100 feet (30,480 mm) apart.

**Note:** For illustrated diagrams pertaining to this section see Figures 31B-6 and 31B-7.

**3111B.2 Ladders.** Ladders shall be corrosion resistant and shall be equipped with slip resistant tread surfaces. Ladders shall be rigidly installed and shall provide a clearance of not less than 3 inches (76 mm) or more than 5 inches (127 mm) between any part of the ladder and the pool wall.

**3111B.3 Stairs.** Stairs shall be provided in the shallowest portion of a pool. In pools with more than one shallow end stairs shall be provided at each shallow end. Each step of a stair shall have a tread in accordance with Figure 31B-7. Risers shall conform to Figure 31B-7. At least one hand rail shall be provided extending from the deck to not less than a point above the top of the lowest step installed in accordance with Figure 31B-7.

**3111B.4 Recessed steps and step risers.** Ladder treads and recessed steps shall have a minimum tread of 5 inches (127 mm) and a width of 14 inches (356 mm) and shall be designed to be readily cleaned. Step risers shall be uniform and shall not exceed 12 inches (305 mm) in height. The first riser shall be measured from the deck.

**3111B.5 Hand rails.** Hand rails shall be provided at the top of both sides of each ladder and recessed steps and shall extend over the coping or edge of the deck.

**3111B.6 Stairs for a spa pool.** Each step of a spa pool stair shall have a tread dimension in accordance with Figure 31B-7. Risers shall not exceed 12 inches (305 mm) in height. Two hand rails shall be provided extending from the deck to not less than a point above the top of the lowest step in accordance with Figure 31B-7. The steps shall be located where the deck is at least 4 feet (1219 mm) wide.

## SECTION 3112B HANDHOLDS

**3112B.1 General.** Every pool shall be provided with handholds (perimeter overflow system, bull-nosed coping or cantilevered decking) around the entire perimeter installed not greater than 9 inches (229 mm) above the waterline.

**Exception:** Handholds are not required for wading pools.

**3112B.2** For special purpose pools used for instruction or competitive swimming, a handhold at water level similar to the rim of a perimeter overflow system is required.

**3112B.3** Where perimeter overflow systems are not provided, a bull-nosed coping or cantilevered decking of reinforced concrete, or material equivalent in strength and durability, with rounded slip resistant edges shall be provided. The overhang for either bull-nosed coping or cantilevered decking shall not exceed 2 inches (51 mm) or be less than 1 inch (25 mm) and shall not exceed 2½ inches (64 mm) in thickness.

**Exception:** The enforcing agent may accept other handholds for spa pools.

## SECTION 3113B DIVING BOARDS AND PLATFORMS

**3113B.1 General.** Diving boards and platforms shall be anchored to the pool deck, constructed of corrosion resistant material, designed and constructed to be easily cleanable and finished with a durable slip resistant material.

**3113B.2 Rails and steps.** Diving boards or platforms greater than 18 inches (456 mm) in height above the deck shall be provided with a ladder or stairs for access. Hand rails shall be provided at all ladders and stairs leading to diving boards or platforms more than 1 meter above the water. Diving boards and platforms that are over 1 meter above the water shall have guard rails on both sides of the diving board or platform that extend to a point on the platform directly above the water's edge. Guard rails shall be 36 inches (914 mm) above the diving board or platform.

**3113B.3 Dimensions.** Dimensions and clearances for the use of diving boards or platforms shall conform to those shown in Figures 31B-1 and 31B-2. Platforms and diving boards shall conform to the USA Diving Rules and Codes, Part 1, Subpart A and Appendix B, effective January 1, 2010.

## SECTION 3114B POOL DECKS

**3114B.1 General.** A minimum continuous and unobstructed 4-foot wide (1219 mm) slip resistant, cleanable, nonabrasive deck area of concrete or like material shall be provided flush with the top of the pool coping extending completely around the pool, and the deck area shall further extend 4 feet (1219 mm) on both sides and rear of any diving board, fixed disabled access assistance device or slide and their appurtenances. The deck width shall be measured from the poolside edge of the coping lip.

### Exceptions:

1. A deck at least 4 feet (1219 mm) in width shall extend around a continuous 50 percent or more of the perimeter of a spa pool. For spa pools that have their walls extending above the ground or floor level, the deck area requirement shall apply at the ground or floor level unless otherwise approved in writing by the enforcing agent.
2. [DSA-AC] Any mechanism provided to assist persons with disabilities in gaining entry into the pool and in exiting from the pool shall comply with Chapter 11B.

**3114B.2 Deck between pools and/or spas.** Where multiple pools and/or spas are built adjacent to each other, the deck width separating them shall be a minimum of 6 feet (1830 mm).

**3114B.3 Deck slope.** The pool's deck surface shall have a slope of no less than 1 percent (1/8 inch per foot) but no more than 2 percent (1/4 inch per foot) away from the pool to a deck drainage system and shall be constructed and finished to prevent standing water.

**3114B.4 Deck covering.** Deck coverings or other materials that are not equivalent to concrete in strength, durability and slip resistance and are not able to withstand repeated brushing, scrubbing or cleaning procedures shall not be installed or used within 4 feet (1219 mm) of the pool.

**3114B.5 Unpaved areas.** Landscape plants, flower beds or similar unpaved areas shall not be located within 4 feet (1219 mm) of a spa pool.

## SECTION 3115B POOL LIGHTING

**3115B.1 General.** Pools shall have underwater and deck lighting such that lifeguards or other persons may observe, without interference from direct and reflected glare from the lighting sources, every part of the underwater area and pool surface, all diving boards or other pool appurtenances. If underwater or deck surface lighting is not operational, the operator of the pool shall secure the pool area and not permit any use of the pool after dark and shall post the same sign as required in Section 3120B.9.

**Note:** See Part 3, Article 3-680, Title 24, California Code of Regulations for electrical installation requirements.

**3115B.2 Nighttime use.** Pools used at night shall be equipped with underwater lighting fixtures that will provide complete illumination to all underwater areas of the pool with no blind



spots. Illumination shall enable a lifeguard or other persons to determine whether:

1. A pool user is lying on the bottom of the pool; and
2. The pool water conforms to the definition of “clear pool water.”

**Exception:** Pools provided with a system of overhead lighting fixtures where it can be demonstrated to the enforcing agent that the system is equivalent to the underwater lighting fixture system.

**3115B.3 Deck area lighting.** When the pool is to be used at night, pool deck areas and emergency egress areas shall be provided with lighting so that persons walking on the deck can identify hazards. Lighting fixtures shall be aimed towards the deck area and away from the pool surface insofar as practical.

## ANCILLARY FACILITIES

### SECTION 3116B BATHHOUSE, DRESSING, SHOWER AND TOILET FACILITIES

**3116B.1** Shower and dressing facilities shall be provided for users of a pool.

**Exceptions:**

1. Shower and dressing facilities may not be required when pool users have access to such facilities in adjacent living quarters.
2. Public toilet facilities may be omitted when pool users have access to toilet facilities either in living quarters located not more than 300 feet (91,440 mm) in travel distance from the pool or in an adjacent building such as a recreational facility, clubhouse or cabana.

**3116B.2 Number of sanitary facilities.** For the purpose of this subsection, one pool user shall be considered for every 15 square feet (1.39 m<sup>2</sup>) of pool water surface area.

**3116B.2.1 Showers.** One shower shall be provided for every 50 pool users.

**3116B.2.2 Toilets.** Separate toilet facilities shall be provided for each sex. One toilet shall be provided for every 60 women or less and one toilet plus one urinal for every 75 men or less.

**3116B.2.3 Lavatories.** One lavatory shall be provided for every 80 pool users.

**3116B.3 Construction.**

**3116B.3.1 Floors.** Floors shall have a hard, nonabsorbent surface, such as portland cement concrete, ceramic tile or other approved material, which extends upwards onto the wall at least 5 inches (127 mm) with a coved base. Floors which may be walked on by a wet pool user shall be slip resistant. Floors shall be sloped not less than 1/4 inch (6.4mm) per foot to floor drains or other approved surface water disposal areas. Carpeting and other similar artificial

floor covering shall not be permitted on shower and toilet room floors.

**3116B.3.2 Interior surfaces.** The materials used in the walls, except for structural elements, shall be of a type which is not adversely affected by moisture.

**3116B.3.3 Privacy.** All doors and windows shall be arranged to prevent viewing of the interior from any portion of the building used by the opposite sex and from view from the outdoors. View screens shall be permitted for this purpose.

**3116B.4 Water supply.**

**3116B.4.1** Showers and lavatories shall be provided with hot and cold water faucets.

**3116B.4.2** Tempered water shall be permitted in lieu of individual hot and cold water faucets.

**3116B.4.3** A means to limit the hot water to 110°F (43°C) maximum shall be provided to prevent scalding. This temperature limit control shall not be adjustable by the pool user.

### SECTION 3117B DRINKING FOUNTAINS

One guarded jet drinking fountain shall be provided for the first 250 pool users and an additional fountain shall be provided for each additional 200 pool users or fraction thereof. The number of pool users shall be determined according to Section 3116B.2.

**Exception:** Drinking fountains shall not be required when drinking water is available at adjacent living quarters, or in an adjacent building such as a bathhouse, cabana, clubhouse or recreational facility.

### SECTION 3118B HOSE BIBBS

Potable water outlets with hose attachments shall be protected by a nonremovable hose bibb backflow preventer, a nonremovable hose bibb vacuum breaker or by an atmospheric vacuum breaker installed not less than 6 inches (152 mm) above the highest point of usage located on the discharge side of the last valve as required by the California Plumbing Code. In climates where freezing temperatures occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used. Hose bibbs shall be provided so that all portions of the pool deck area may be reached with a 75 foot length of hose attached to the hose bibb. A hose bibb shall be provided in the equipment area. Hose bibbs shall be located so that they do not constitute a hazard.

### SECTION 3119B POOL ENCLOSURE

**3119B.1 Enclosure.** The pool shall be enclosed by one or a combination of the following: a fence, portion of a building, wall, or other approved durable enclosure. Doors, windows,

gates of living units or associated private premises shall not be permitted as part of the pool enclosure. The enclosure, doors and gates shall meet all of the following specifications:

1. The enclosure shall have a minimum effective perpendicular height of 5 feet (1524 mm) as measured from the outside as depicted in Figure 31B-4; and
2. Openings, holes or gaps in the enclosure, doors and/or gates shall not allow the passage of a 4-inch (102 mm) diameter sphere. The enclosure shall be constructed over a hard and permanent material equivalent to concrete; and
3. The enclosure shall be designed and constructed so that it cannot be readily climbed by small children. Horizontal and diagonal member designs which might serve as a ladder for small children are prohibited. Horizontal members shall be spaced at least 48 inches (1219 mm) apart. No planters or other structures that can be climbed shall be permitted within 5 feet (1524 mm) of the outside of the pool enclosure or within a 5 foot (1524 mm) arc as depicted in Figure 31B-5. The area 5 feet (1524 mm) outside of the pool enclosure shall be a common area open to the public; and
4. Chain link may be used, provided that the openings are not greater than  $1\frac{3}{4}$  inches (44 mm) measured horizontally.

**Note:** [DSA-AC] Any mechanism provided to assist persons with disabilities in gaining entry into the pool enclosure and in exiting from the pool enclosure shall comply with Chapter 11B.

**3119B.2 Gates.** Gates and doors opening into the pool enclosure also shall meet the following specifications:

1. Gates and doors shall be equipped with self-closing and self-latching devices. The self-latching device shall keep the gate or door securely closed. Gates and doors shall open outwardly away from the pool except where otherwise prohibited by law. Hand activated door or gate opening hardware shall be located at a height no lower than 42 inches (1067 mm) but no higher than 44 inches (1119 mm) above the deck or walkway; and
2. Gates and doors shall be capable of being locked during times when the pool is closed. Exit doors which comply with Chapter 10, Title 24, California Code of Regulations shall be considered as meeting these requirements; and
3. The pool enclosure shall have at least one means of egress without a key for emergency purposes. Unless all gates or doors are so equipped, those gates and/or doors which will allow egress without a key shall have a sign in letters at least 4 inches (102 mm) high stating **EMERGENCY EXIT**; and
4. The enclosure shall be constructed so that all persons will be required to pass through common pool enclosure gates or doors in order to gain access to the pool area. All gates and doors exiting the pool area shall open into a public area or a walkway accessible by all patrons of the pool.

**3119B.3 Retroactivity.** Sections 3119B.1 and 3119B.2 shall apply only to public pool enclosures constructed on or after July 1, 1994. Notwithstanding the foregoing effective date, no fence enclosure shall be less than 4 feet (1219 mm) in height.

#### **3119B.4 Enclosure of pools constructed prior to July 1, 1994.**

The enforcing agent may allow the installation of an enclosure which reduces the pool deck to less than 4 feet (1219 mm) in width when the physical characteristics of a site preclude providing a 4-foot (1219 mm) wide deck around the perimeter of an existing pool.

### **SECTION 3120B REQUIRED SIGNS**

**3120B.1 General.** All signs shall have clearly legible letters or numbers not less than 4 inches (102 mm) high, unless otherwise required in this section, affixed to a wall, pole, gate or similar permanent structure in a location visible to all pool users.

**3120B.2 Pool user capacity sign.** A sign shall indicate the maximum number of pool users permitted for each pool.

**3120B.2.1 Spa pool.** The pool user capacity of a spa pool shall be based on one pool user for every 10 square feet (0.929 m<sup>2</sup>) of pool water surface area.

**3120B.2.2 Other pools.** The pool user capacity for all other pools shall be based on one pool user for every 20 square feet (1.858 m<sup>2</sup>) of pool water surface area.

**Exception:** Pool user capacity requirements do not apply to wading pools or spray grounds.

**3120B.3 No diving sign.** Signs shall be posted in conspicuous places and shall state, "NO DIVING" at pools with a maximum water depth of 6 feet or less.

**3120B.4 No lifeguard sign.** Where no lifeguard service is provided, a sign shall be posted stating, "NO LIFEGUARD ON DUTY." The sign also shall state in letters at least 1 inch (25 mm) high, "Children under the age of 14 shall not use pool without a parent or adult guardian in attendance."

**3120B.5 Artificial respiration and cardiopulmonary resuscitation sign.** An illustrated diagram with text at least  $\frac{1}{4}$  inch (6 mm) high of artificial respiration and cardiopulmonary resuscitation procedures shall be posted.

**3120B.6 Emergency sign.** The emergency telephone number 911, the number of the nearest emergency services and the name and street address of the pool facility shall be posted.

**3120B.7 Warning sign for a spa pool.** A warning sign for spa pools shall be posted stating, "CAUTION" and shall include the following language in letters at least 1 inch (25 mm) high:

1. Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering the spa.
2. Unsupervised use by children under the age of 14 is prohibited.
3. Hot water immersion while under the influence of alcohol, narcotics, drugs or medicines may lead to serious consequences and is not recommended.
4. Do not use alone.
5. Long exposure may result in hyperthermia, nausea, dizziness or fainting.

**3120B.8 Emergency shut off.** In letters at least one inch (25 mm) high a sign shall be posted at the spa emergency shut off switch stating, "EMERGENCY SHUT OFF SWITCH."

**3120B.9 No use after dark.** Where pools were constructed for which lighting was not required, a sign shall be posted at each pool entrance on the outside of the gate(s) stating, "NO USE OF POOL ALLOWED AFTER DARK."

**3120B.10 Keep closed.** A sign shall be posted on the exterior side of gates and doors leading into the pool enclosure area stating, "KEEP CLOSED."

**3120B.11 Diarrhea.** A sign in letters at least 1 inch (25 mm) high and in a language or diagram that is clearly stated shall be posted at the entrance area of a public pool which states that persons having currently active diarrhea or who have had active diarrhea within the previous 14 days shall not be allowed to enter the pool water.

**3120B.12 Wave pools.** A sign in letters at least 1 inch (25 mm) high shall be posted that describes the requirements for wave pools as described in Section 115952, Health and Safety Code.

**3120B.13 Spray ground sign.** A sign shall be posted at each spray ground and be visible from any part of the spray ground that states, "CAUTION: WATER IS RECIRCULATED. DO NOT DRINK."

**3120B.14 Exit.** Where automatic gaseous chlorine chemical feeders are used, a sign shall be posted at the pool area entrance which shows in a diagrammatic form an emergency evacuation procedure. Designated emergency exits shall be marked "EXIT."

**3120B.15 Gaseous oxidizer.** Where automatic gaseous chlorine chemical feeders are used, a warning sign with the appropriate hazard identification symbol shall be posted on the exterior side of the door entering the chemical feeder room or area. The sign shall state, "DANGER: GASEOUS OXIDIZER - (specific chemical name)" or as otherwise required by the California Fire Code.

**3120B.16 Turn on before entering.** Where automatic gaseous chemical feeders are used, a sign shall be posted at the switch to the light and ventilation system for the gaseous chemical feeder room stating, "TURN ON BEFORE ENTERING," or as otherwise required by the California Fire Code or the California Electrical Code.

**3120B.17 Direction of flow.**

**3120B.17.1.** The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area.

**3120B.17.2.** Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the system serves.

**3120B.17.3.** Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.

## SECTION 3121B INDOOR POOL VENTILATION

Indoor pools, dressing rooms and toilet rooms shall be ventilated according to the requirements in Chapter 4 of the California Mechanical Code.

## SECTION 3122B POOL EQUIPMENT ENCLOSURE

For pools constructed on or after January 1, 2013, pool equipment shall be enclosed as follows:

1. All equipment installed for recirculation, filtration and disinfection of pool water shall be installed so that access is limited to persons authorized by the pool owner or operator; and
2. Pool equipment shall be mounted on a continuous slab of concrete or other equivalent easily cleanable and nonabsorbent material; and
3. Floors shall be sloped a minimum of  $1/4$  inch (6.4 mm) per foot to a drain.

## RECIRCULATION SYSTEM COMPONENTS

### SECTION 3123B GENERAL REQUIREMENTS

**3123B.1 System description.** Each pool shall be provided with a separate recirculation system designed for the continuous recirculation, filtration and disinfection of the pool water. The system shall consist of pumps, filters, chemical feeders, skimmers or perimeter overflow systems, valves, pipes, connections, fittings and appurtenances.

**Exception:** Pools using fresh water equivalent in flow to the requirements of Section 3124B.

**Note:** Fresh makeup pool water shall conform to the water quality standards of Section 65531, Chapter 20, Title 22, California Code of Regulations.

**3123B.2 Equipment.** All pumps, filters, chemical feeders, skimmers and supplemental equipment shall comply with the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

**3123B.3 Installation.** All equipment related to pool operations shall be installed and maintained according to this chapter and in accordance with the equipment manufacturer's written instructions.



**3123B.4 Equipment access.** All filters, valves, pumps, strainers and equipment shall be readily accessible for repair and replacement.

### **SECTION 3124B TURNOVER TIME**

The recirculation system shall have the capacity to provide a complete turnover of pool water in:

1. One-half hour or less for a spa pool; and
2. One-half hour or less for a spray ground; and
3. One hour or less for a wading pool; and
4. Two hours or less for a medical pool; and
5. Six hours or less for all other types of public pools.

### **SECTION 3125B RECIRCULATION PIPING SYSTEM AND COMPONENTS**

**3125B.1 Line sizes.** Pipes shall be sized so flow velocity of piping systems including all pipes and fittings other than inlet devices or venturi throats shall not exceed 6 feet per second (1.829 m/s) in any suction or copper piping and 8 feet per second (2.438 m/s) in any portion of the return system.

**3125B.1.1 Materials.** All piping, tubing and fittings shall comply with the applicable standards for potable water system materials set forth in Chapter 6 of the California Plumbing Code.

**3125B.2 Gauges.** A pressure and vacuum gauge shall be provided for each pump system. Each gauge shall have a scale range approximately  $1\frac{1}{4}$  times the maximum anticipated working pressure or vacuum and shall be accurate within 2 percent of scale.

**3125B.3 Flow meter.** A flow meter shall be provided on each recirculation system accurate to within 10 percent of flow and installed according to the manufacturer's written instructions with increments in the range of normal flow.

**3125B.4 Basket strainer.** A basket strainer shall be provided on the suction side of the recirculation pump. A basket strainer will not be required on pumps connected to vacuum filters where the filter elements are not removed for cleaning.

**3125B.5 Backwash piping.** Piping, including necessary valves conforming to Section 3125B.1, shall be provided for each filter vessel or element which requires periodic backwashing.

**3125B.6 Valves.** Valves shall not be located in any deck area surrounding a pool. Valves shall be installed on all recirculation, backwashing and drain system lines which require shutoff isolation, adjustment or control of the rate of flow. Each valve shall be installed in the equipment area and labeled as to its purpose.

### **SECTION 3126B RECIRCULATION PUMP CAPACITY**

**3126B.1** Pool recirculation pumps shall have the following total dynamic head capacities:

1. **Pressure diatomaceous earth filters.** At least 60 feet (18,288 mm); and
2. **Vacuum diatomaceous earth filters.** Twenty inches (508 mm) vacuum on the suction side and 40 feet (12,192 mm) total dynamic head; and
3. **Rapid sand filters.** At least 45 feet (13,716 mm); and
4. **High rate sand filters.** At least 60 feet (18,288 mm); and
5. **Cartridge filters.** At least 60 feet (18,288 mm).

**3126B.2.** Pumps with other total dynamic head capacities shall be permitted provided the turnover times are maintained as required in Section 3124B.

### **SECTION 3127B WATER SUPPLY INLETS**

**3127B.1 General.** Each pool shall be supplied with potable water by means of a permanently installed pipeline from a public water supply system holding a permit from the California Department of Public Health or from a source approved by the enforcing agent.

**3127B.2 Backflow prevention.** There shall be no direct connection between any potable water supply system and the pool or its piping system unless protected by a backflow prevention device in accordance with Chapter 6 of the California Plumbing Code.

**3127B.3 Makeup water.** Automatic makeup water flow controls with a manual override control shall be provided to maintain the proper pool water level.

### **SECTION 3128B FILTERS (ALL TYPES)**

**3128B.1 General requirements.** All filters, regardless of type, shall be designed and constructed according to the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

**3128B.2 Installation.** Each filter vessel shall be installed, piped and provided with valves so that it can be isolated from the recirculation system for repairs and backwashing.

### **SECTION 3129B RAPID SAND PRESSURE FILTERS**

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to rapid sand pressure filters.

**3129B.1 Flow rates.** The filtration rate shall not exceed 3 gallons per minute per square foot (122.24 L/m per m<sup>2</sup>) of filter

area. The backwash rate shall not be less than 15 gallons per minute per square foot ( 611.2 L/m per m<sup>2</sup>) of filter area.

**3129B.2 Filter media.** The filter shall contain not less than a 20-inch (508 mm) depth of media and not less than a 10-inch (254 mm) depth of filter gravel above the underdrain system.

**3129B.2.1** The filter media shall have an effective particle size between 0.40 and 0.55 millimeters and a uniformity coefficient not exceeding 1.75.

**3129B.2.2** The filter gravel shall be sized and placed to provide uniform flow distribution from the underdrain system and to support the bed of filter sand without loss of sand to the pool or without development of jet streams or channeling in the filtration media.

### SECTION 3130B DIATOMACEOUS EARTH FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following applies to diatomaceous earth filters.

**3130B.1 Flow rates.** The filtration rate for both pressure and vacuum diatomaceous earth filters shall not exceed 2 gallons per minute per square foot (81.49 L/m per m<sup>2</sup>) of filter area.

### SECTION 3131B HIGH-RATE SAND FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to high rate sand filters.

**3131B.1 Flow rates.** Maximum and minimum flow rates for backwash and filtration shall be maintained according to the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

**3131B.2** The filter media shall have an effective particle size between 0.40 and 0.55 mm and a uniformity coefficient not exceeding 1.75.

**3131B.3** The backwash rate for a high rate sand filter shall be a minimum of 15 gallons per minute per square foot of filter area.

### SECTION 3132B CARTRIDGE FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to cartridge filters.

**3132B.1** The filtration rate shall not exceed 0.375 gallons per minute per square foot of filter area.

**3132B.2** An approved wash down area equipped with potable water shall be provided in the pool equipment area with permanently installed drainage piping discharging to the public sewer or wastewater system approved by the enforcing wastewater agency. The filter vessel shall be capable of being drained and shall be equipped with an indirect drain for the purpose of draining the entire contents of the filter vessel. Drainage and backwash piping shall be considered indirect

waste and installed in accordance with the requirements of Chapter 8 of the California Plumbing Code.

**3132B.3** An additional set of filter elements shall be available for installation while the existing filter elements are cleaned.

### SECTION 3133B CHEMICAL FEEDERS

All chemical feeders including disinfectant feeders and the auxiliary feeders used for solutions, slurries or solids, along with components such as pumps, strainers, tubing connections, tanks and injection fittings shall comply with the provisions of this section.

**3133B.1 General design requirements.** The chemical feeder equipment shall:

1. Be maintained and repaired according to manufacturers' specifications; and
2. Be constructed with an adjustable output rate device to permit repeated adjustments without loss of output rate accuracy and adjusted by an automatic chemical monitoring and control system that regulates, at a minimum, pH and disinfectant; and
3. Meet the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

**3133B.2 Piping.** Piping used for the chemical feeder and its auxiliary equipment shall be resistant to corrosion or chemical deterioration.

**3133B.3 Installation.** Chemical feeders and associated components shall be constructed and installed to prevent uncontrolled discharge or siphoning of chemicals and fumes directly into the pool, its recirculation system, the pool area or ancillary facilities.

### SECTION 3134B DISINFECTANT FEEDERS

Disinfectant feeders shall comply with applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010 for disinfectant feeders. In addition to the requirements for chemical feeders as indicated in Section 3133B, the following apply to disinfectant feeders.

**3134B.1 Minimum capacity.** All feeders shall be capable of supplying not less than the equivalent of 3 pounds (1 kg) of 100 percent available chlorine per day per 10,000 gallons (37,850 L) of pool water capacity.

**3134B.2 Rate of flow adjustment.** A visible means of determining the rate of flow through the device shall be provided for each disinfectant feeder.

**3134B.3 Compressed chlorine gas disinfectant equipment.** Chlorine gas shall not be dispensed directly into the water of a pool except as an aqueous solution through the return line of the recirculation system.



**3134B.3.1 Compressed gas containers.** Each container or cylinder shall be secured to prevent accidental movement. A valve protection cap shall be provided to cover the discharge valve at all times when the cylinder is not connected to the dispensing system.

**3134B.3.2 Container scale.** Compressed gas chlorine containers in use shall be on a scale in the gas chlorinator room.

**3134B.3.3 Chlorine feeding device.** The chlorine feeding device shall be capable of delivering chlorine in an aqueous solution at the maximum design rate. The device shall not allow the backflow of pool water into the chlorine container. The device shall not allow the release of chlorine gas to the atmosphere under normal operating conditions. The device shall be designed and installed to conduct chlorine gas leaks to the outdoors during a release of chlorine gas or an interruption of the water supply.

**3134B.3.4 Piping.** Piping carrying chlorine gas under pressure shall not be located outside the gas chlorination equipment room.

## SECTION 3135B GAS CHLORINATION EQUIPMENT ROOM

Compressed chlorine gas storage containers and auxiliary components shall be installed indoors in a separate room of not less than 1-hour fire resistant construction and shall comply with the California Fire Code and all of the following.

**3135B.1 Location.** The gas chlorination equipment room shall not be located in any habitable building, above the first floor or below ground level.

**3135B.2. Exit.** Required exit doors shall swing in the direction of exit of travel and shall not open directly toward the pool or pool deck.

**3135B.3 Ventilation.** Mechanical exhaust ventilation systems shall be in compliance with the California Mechanical Code.

**3135B.4 Alarm.** An audible and visible chlorine detection alarm system shall be located in the room containing the gas chlorine equipment. The sensor shall be located within 6 inches (152 mm) of the floor level. The system shall continually monitor the room and shall activate when chlorine concentrations in the room exceed a Permissible Exposure Limit of 0.5 ppm. Activation of the alarm shall shut off the chlorine at the source and turn on the lights and ventilation system. The alarm system shall consist of the following:

1. An audible alarm capable of producing a sound level of at least 90 decibels; and
2. A visible alarm consisting of a strobe light which is mounted directly over the entrance to the chlorine equipment room. The light shall be visible during daylight hours.

**3135B.5 Illumination.** Artificial illumination of at least 50 footcandles as measured 30 inches (750 mm) from the floor shall be provided in the room.

**3135B.6 Switches.** Switches for the control of mechanical ventilation and lighting fixtures shall be located adjacent to the entry door outside the room.

**3135B.7 Equipment interlocks.** The gas chlorine feeding device shall be interlocked with the pool recirculating pump so that the gas chlorine feeding device shall not operate when the recirculating pump is off or during the filter backwash.

**3135B.8 Storage.** The gas chlorine room shall not be used for the storage of items not related to the use of the gas chlorine equipment.

## SECTION 3136B POOL SKIMMING SYSTEMS

The pool shall be equipped with one or more skimming methods to provide continuous skimming of the pool water and shall be capable of continually withdrawing not less than 100 percent of the required flow rate.

**3136B.1 Surface skimmers.** Each surface skimmer shall comply with the following provisions:

1. The skimmer shall be recessed into the pool wall; and
2. The skimmer shall be individually adjustable for the rate of flow with either an external or internal device; and
3. If used, a skimmer equalizer suction outlet shall be connected to at least two suction grate assemblies that meet the ANSI/APSP-16 2011 performance standard and are located at least 3 feet (915 mm) apart in any dimension between the suction outlets; and
4. The skimmer weir shall automatically adjust to variations in the pool water level over a range of not less than 4 inches (102 mm); and
5. Each skimmer shall be provided with a removable and cleanable screen or basket to trap objects. The screen or basket shall be accessible through an opening in the deck above the skimmer; and
6. There shall be a minimum of one skimmer for every 500 square feet or less of pool water surface area or an adequate number to meet 100 percent of pump flow at the manufacturer's maximum flow rating, whichever is greater; and
7. Each skimmer shall be located in relation to pool inlets to aid recirculation and surface skimming; and
8. All surface skimmers shall comply with applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

**3136B.2 Perimeter overflow systems.** A perimeter overflow system shall be required in pools whose water surface area equals or exceeds 5,000 square feet (464.52 m<sup>2</sup>). Perimeter overflow systems shall be designed by an engineer or architect who has experience working on public pools and shall comply with the following provisions:

1. **Location.** The overflow system shall be integrated with the pool structure and extend completely around the pool parallel to the pool deck except where an entry or exit may require interruption; and

2. **Channel detail.** The overflow channel shall be not less than 3 inches (76 mm) deep, the section shall not diverge with depth of the channel, and the width of the bottom shall be not less than 3 inches (76 mm). The opening beneath the coping into the overflow system shall be a minimum of 4 inches (102 mm) beneath the coping in any direction measured radially from the inner edge of the overflow channel lip; and
3. **Channel lip.** The overflow channel lip shall be not more than 12 inches (305 mm) below the level of the coping or deck. The lip edge shall be rounded and shall be not thicker than 2½ inches (64 mm) or thinner than 1 inch (25 mm) for the top 2 inches (51 mm); and
4. **Channel covering.** Covered overflow channels shall be permitted provided the openings do not exceed ½ inch in the smaller dimension; and
5. **Channel outlets.** Channel outlet spacing and channel bottom slope shall be hydraulically designed by an engineer or architect who has experience working on public pools; and
6. **Channel outlet covers.** Overflow channel outlet covers shall be accessible for cleaning and maintenance. Openings of the channel outlet covers shall not pass a ½ inch (13 mm) sphere in the smaller dimension; and
7. **Channel drain piping.** Channel drain piping shall provide drainage of the overflow system, carry overflow water to a surge basin and return to skimming within 10 minutes after being flooded by a sudden displacement of the pool water by pool users; and
8. **Surge storage capacity.** A perimeter overflow system shall be provided with a minimum surge storage capacity of not less than 1 gallon per square foot (40.75 L/m²) of pool water surface area. Surge storage shall be permitted in the surge basin, perimeter overflow channel and in the channel drain piping returning to the surge basin.

### SECTION 3137B POOL FITTINGS

**3137B.1 Outlets.** Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump. Suction outlets shall comply with all of the following provisions:

1. Each pump on a pool system shall be connected to at least two suction outlets. The suction outlets shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings and shall be separated by a distance of at least 3 feet (915 mm) in any dimension between the suction outlets; and
2. All suction outlets shall be equipped with suction fittings that meet the ANSI/APSP-16 2011 performance standard; and
3. The velocity of the suction piping installed between the suction outlets shall not exceed 3 feet per second (.91 mps); and

4. **Hydrostatic relief devices.** In areas with a high groundwater table, or as required by local plumbing codes, a hydrostatic relief device shall be installed. When used in conjunction with a safety vacuum release system, the hydrostatic relief device must meet the manufacturer's installation requirements for the safety vacuum release system.

**Exception:** Alternative outlet locations that have been designed by a licensed engineer who has experience working on public pools may be used if approved by the enforcing agent.

**3137B.2 Inlet fittings.** Each pool shall be provided with not less than two recirculation system inlets for the first 10,000 gallon (37,850 L) capacity and one additional inlet for each additional 10,000 gallon (37,850 L) or less capacity.

**3137B.2.1 Construction.** Inlet fittings shall not protrude greater than 1¼ inches (32 mm) into the pool and shall be shaped, rounded and smooth.

**3137B.2.2 Location.** Inlet fittings shall be located no less than 18 inches (457 mm) below the waterline, except for a spa pool or wading pool. Inlet fittings shall be separated by at least 10 feet (3048 mm) and shall be located so as to ensure uniform circulation.

**3137B.2.3 Adjustment.** Provisions shall be made for adjusting the volume of flow through each inlet. Wall inlets shall be capable of adjusting the direction of flow and to produce sufficient velocity to impart a substantial circulatory movement to the pool water.

**3137B.2.4 Floor inlets.** Pools that are greater than 40 feet (12,192 mm) in width or 3,000 square feet (278.7 m²) in surface area shall have floor-mounted return inlets. The number of floor inlets shall be in compliance with Section 3137B.2. All floor inlet fittings shall be located to provide uniform circulation and shall be installed so as to be flush with the surface of the pool bottom.

### SECTION 3138B SPA POOL SPECIAL REQUIREMENTS

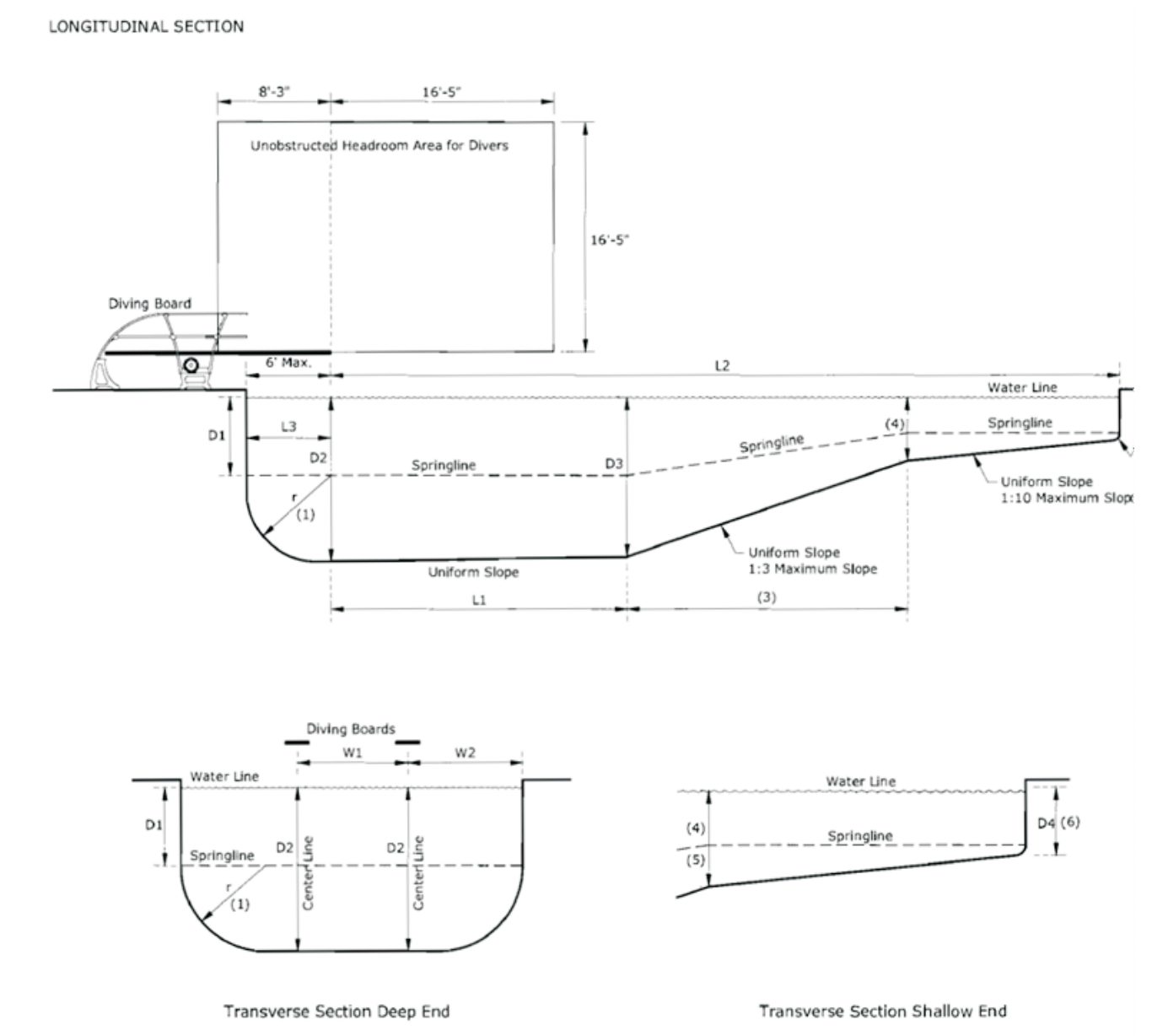
**3138B.1 Aeration system.** A spa pool aeration and/or jet system shall be completely separate from the recirculation system and shall not be interconnected with any other pool.

**3138B.2 Maximum operating temperature.** The allowable water temperature of a spa pool shall not exceed 104° F (40° C).

**3138B.3 Surface area.** The water surface area of a spa pool shall not exceed 250 square feet (23.23 m²).

**3138B.4 Maximum depth.** The water depth in a spa pool shall not exceed 4 feet (1220 mm).

**3138B.5 Emergency shut off switch.** A clearly labeled emergency shut off switch for the control of both the recirculation system and the aeration and/or jet system shall be installed adjacent to the spa pool.



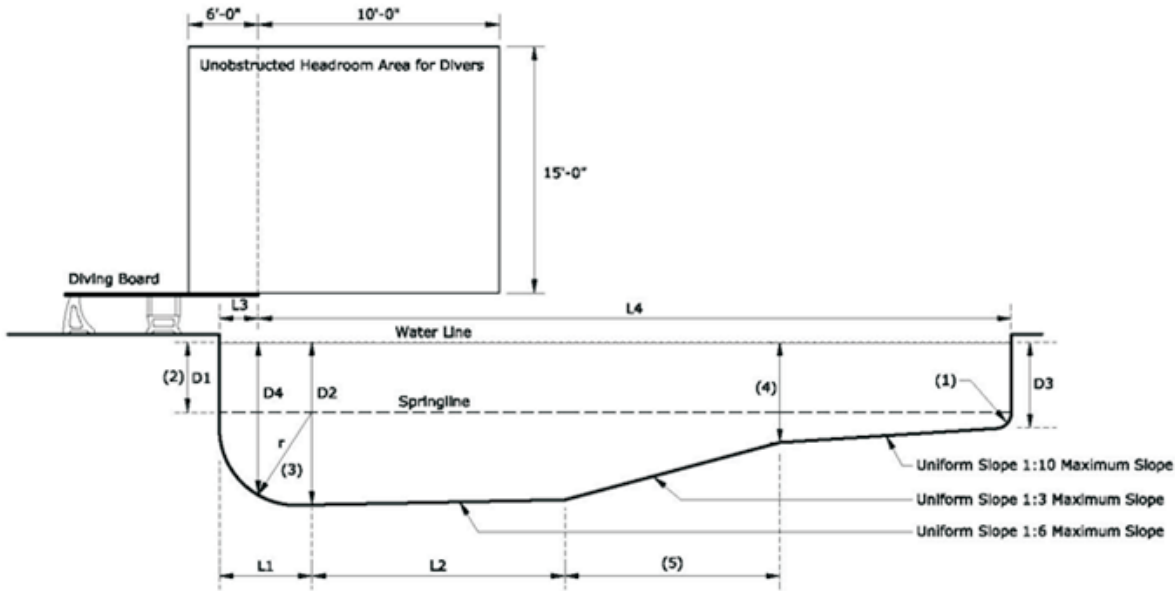
**FIGURE 31B-1**  
**DEPTHS AND CLEARANCES FOR POOLS WITH DIVING BOARDS GREATER THAN 30 INCHES (762 mm) ABOVE THE WATER LINE**

**TABLE 31B-1**

BOARDS AND PLATFORMS	DIM	DEPTH OF WATER				LENGTH OF SECTION				
		D1	D2	D3	D4	L1	L2	L3	W1	W2
1-meter board	Min.	5'-6"	11'-6"	11'-2"	0'-0"	16'-5"	29'-7"	5'-11"	7'-11"	8'-3"
3-meter board	Min.	6'-6"	12'-6"	12'-2"	0'-0"	19'-9"	33'-8"	5'-11"	8'-7"	11'-6"

- Notes for Figure 31B-1 and Table 31B-1:
1. Maximum radius shall equal D2 minus D1 dimensions.
  2. Radius at the shallow end shall not be more than 12 inches.
  3. The length of a section is based on the maximum slope and other maximum and minimum dimensions.
  4. Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".
  5. The springline depth at (4) shall not be more than 4'-0".
  6. The maximum water depth shall be 3'-6".
  7. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.

LONGITUDINAL SECTION



TRANSVERSE SECTION AT D2

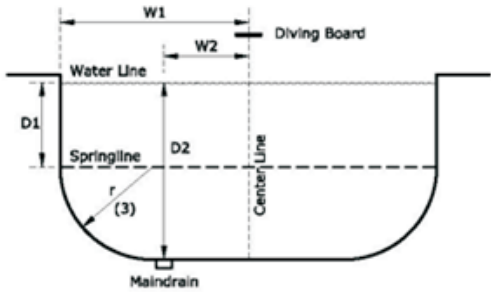


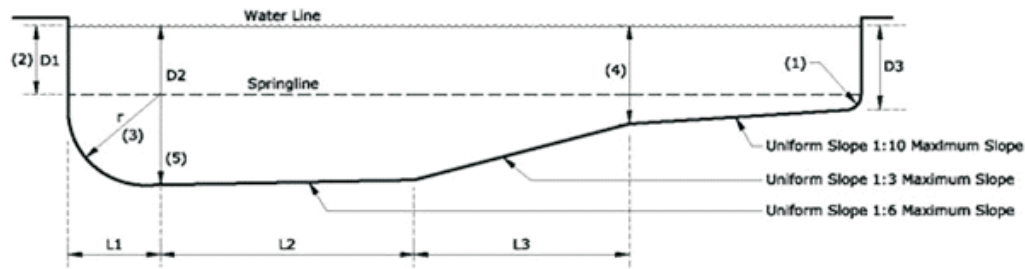
FIGURE 31B-2  
DEPTHS AND CLEARANCES FOR POOLS WITH DIVING BOARDS 30 INCHES (762 MM) OR LESS ABOVE THE WATER LINE

TABLE 31B-2

DIMENSION	DEPTH OF WATER				LENGTH OF SECTION					
	D1	D2	D3	D4	L1	L2	L3	L4	W1	W2
Minimum	2'-6"	8'-6"	0'-0"	7'-0"	6'-0"	6'-0"	2'-6"	30'-0"	9'-0"	3'-0"
Maximum	—	—	3'-6"	—	10'-0"	—	4'-0"	—	—	—

- Notes for Figure 31B-2 and Table 31B-2:
1. Radius at the shallow end shall be a maximum of 1'-0".
  2. Springline D1 shall extend to the break in slope between the shallow area and the deep area.
  3. Maximum radius shall equal D2 minus D1 dimensions.
  4. Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".
  5. Length of section is based on maximum slope and other maximum or minimum dimensions.
  6. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.

LONGITUDINAL SECTION



TRANSVERSE SECTION AT D2

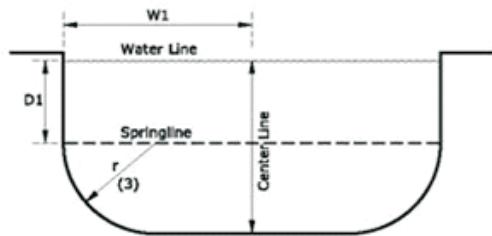


FIGURE 31B-3  
DEPTHS AND CLEARANCES FOR POOLS WITHOUT DIVING BOARDS

TABLE 31B-3A  
POOLS WITH MAXIMUM WATER DEPTH = 6'-0"

DIMENSION	DEPTH OF WATER			LENGTH OF SECTION			
	D1	D2	D3	L1	L2	L3	W1
Minimum	2'-6"	(5)	0'-0"	3'-6"	3'-0"	3'-0"	6'-0"
Maximum	—	6'-0"	3'-6"	—	—	—	—

TABLE 31B-3B  
POOLS WITH MAXIMUM WATER DEPTH > 6'-0"

DIMENSION	DEPTH OF WATER			LENGTH OF SECTION		
	D1	D2	D3	L1	L2	W1
Minimum	2'-6"	(5)	0'-0"	3'-6"	3'-0"	7'-6"
Maximum	—	—	3'-6"	—	—	—

- Notes for Figure 31B-3 and Tables 31B-3a and 31B-3b.
1. Radius at the shallow end shall be a maximum of 1'-0".
  2. Springline D1 shall extend to the break in slope between the shallow area and deep area.
  3. Maximum radius shall equal D2 minus D1 dimensions.
  4. Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".
  5. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.



### **SECTION 3139B SOLAR HEATING INSTALLATIONS**

**3139B.1** Solar heating systems shall comply with the following:

1. Solar heating system suction outlets shall comply with Section 3137B; and
2. Solar heating system suction outlets shall be located no closer than 5 feet (1525 mm) to any pool inlet fitting; and
3. The installation of a solar heating system on a new or existing pool shall not interfere with the required turnover rate as specified in Section 3124B nor exceed the pipe flow velocities as specified in Section 3125B.1.

### **SECTION 3140B CLEANING SYSTEMS**

A vacuum cleaning system shall be available which is capable of removing sediment from all parts of the pool floor. A cleaning system using potable water shall be protected by a backflow prevention device in accordance with Chapter 6 of the California Plumbing Code. No cleaning system shall operate in the pool when the pool is open or available for use by pool users. Built-in vacuum suction lines shall not be installed in the pool.

### **SECTION 3141B WASTEWATER DISPOSAL**

**3141B.1 General requirements.** Material cleaned from filters and backwash water from any recirculation system shall be disposed in a manner that is acceptable to the local wastewater agency and will not create a nuisance. Backwash water shall not be returned to a pool. Pipes carrying wastewater from pools including pool drainage and backwash from filters shall be installed as an indirect waste in accordance with the requirements of Chapter 8 of the California Plumbing Code. Where a pump is used to discharge waste pool water to the drainage system, the pump discharge shall be installed as an indirect waste.

**3141B.2 Diatomaceous earth filters.** The backwash from a diatomaceous earth filter shall discharge into a separation tank that has been installed to collect the waste diatomaceous earth mixture. The wastewater from the separation tank shall discharge into a sanitary sewer or other disposal system acceptable to the local wastewater agency.

**3141B.3 Piping.** Sumps and drain piping shall have sufficient capacity to receive recirculation system backwash without overflow of the sump receiver. The sump shall not permit sewage to enter the surge basin or the pool in the event of a sewage backup.

**3141B.4 Visual indicator.** Where direct observation of the backwash discharge is not visible to the operator during backwash operations, a sight glass shall be installed on the wastewater discharge line.

**3141B.5 Prohibited connection.** There shall be no direct connection between the pool, its recirculation system or overflow drain to any sanitary sewer, storm drain or drainage system.

**SECTION 3142B**  
Reserved

**SECTION 3143B**  
Reserved

**SECTION 3144B**  
Reserved

**SECTION 3145B**  
Reserved

**SECTION 3146B**  
Reserved

**SECTION 3147B**  
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**SECTION 3148B**  
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**SECTION 3149B**  
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**SECTION 3150B**  
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**SECTION 3151B**  
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**SECTION 3152B**  
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**SECTION 3153B**  
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**SECTION 3154B**  
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**SECTION 3155B**  
Reserved

**SECTION 3156B**  
Reserved

**SECTION 3157B**  
**Reserved**

**SECTION 3158B**  
**Reserved**

**SECTION 3159B**  
**Reserved**

**Division II – PUBLIC SWIMMING POOLS**

*Note:* These building standards are in statute but have not been adopted through the regulatory process. Enforcement of these standards set forth in this section does not depend upon adoption of regulations; therefore, enforcement agencies shall enforce the standards pursuant to the timeline set forth in this section prior to adoption of related regulations.

**SECTION 3160B**  
**GROUND FAULT CIRCUIT INTERRUPTERS**

1. "Public swimming pool," as used in this section, means any swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club, including any swimming pool located on the grounds of a hotel, motel, inn, an apartment complex or any residential setting other than a single-family home. For purposes of this section, "public swimming pool" shall not include a swimming pool located on the grounds of a private single-family home, or a swimming pool owned or operated by the state or any local governmental entity as set forth in Section 116049 of the Health and Safety Code.
2. All dry-niche light fixtures, and all underwater wet-niche light fixtures operating at more than 15 volts in public swimming pools, as defined in this section, shall be protected by a ground fault circuit interrupter in the branch circuit, and all light fixtures in public swimming pools shall have encapsulated terminals.
3. Any public swimming pool that does not meet the requirements specified in Item 2 by January 1, 1998, shall be retrofitted to comply with these requirements by July 1, 1998.
4. The ground-fault circuit interrupter required pursuant to this section shall comply with Underwriter's Laboratory standards.
5. The owner or operator of a public swimming pool shall have its public swimming pool inspected by a qualified inspector on or before September 1, 1998, to determine compliance with this section.
6. All electrical work required for compliance with this section shall be performed by an electrician licensed pursuant to Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code.

ant to Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code.

Authority: Health and Safety Code Section 116064 (e)  
Reference: Health and Safety Code Section 116049 SB 1360, (Statutes 1995, c. 415).

**SECTION 3161B**  
**WADING POOLS**

1. "Public wading pool" means a pool that meets all of the following criteria:
  - 1.1. It has a maximum water depth not exceeding 18 inches (457 mm).
  - 1.2. It is a pool other than a pool that is located on the premises of a one-unit or two-unit residence, intended solely for the use of the residents or guests.
2. "Public wading pool" includes, but is not limited to, a pool owned or operated by private persons or agencies, or by state or local governmental agencies.
3. "Public wading pool" includes, but is not limited to, a pool located in an apartment house, hotel or similar setting that is intended for the use of residents or guests.
4. "Alteration" means any of the following:
  - 4.1. To change, modify or rearrange the structural parts or the design.
  - 4.2. To enlarge.
  - 4.3. To move the location of.
  - 4.4. To install a new water circulation system.
  - 4.5. To make any repairs costing fifty dollars (\$50) or more to an existing circulation system.
5. A public wading pool shall have at least two circulation drains per pump that are hydraulically balanced and symmetrically plumbed through one or more T fittings, and are separated by a distance of at least 3 feet (914 mm) in any dimension between drains.
6. All public wading pool main drain suction outlets that are under 12 inches (305 mm) across shall be covered with antivortex grates or similar protective devices. All main drain suction outlets shall be covered with grates or antivortex plates that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.
7. The maximum velocity in the pump suction hydraulic system shall not exceed 6 feet per second (1.8 m/s) when 100 percent of the pump's flow comes from the main drain system and any main drain suction fitting in the system is completely blocked.
8. On or after January 1, 1998, all newly constructed public wading pools shall be constructed in compliance with this section.

9. Commencing January 1, 1998, whenever a construction permit is issued for alteration of an existing public wading pool, it shall be retrofitted so as to be in compliance with this section.
10. By January 1, 2000, every public wading pool, regardless of the date of original construction, shall be retrofitted to comply with this section.

Authority: Health and Safety Code Section 116064 (e)  
Reference: Health and Safety Code Section 116064 AB 2114, (Statutes 1995, c. 415).

## SECTION 3162B ANTI-ENTRAPMENT DEVICES AND SYSTEMS

1. The Legislature finds and declares that the public health interest requires that there be uniform statewide health and safety standards for public swimming pools to prevent physical entrapment and serious injury to children and adults. It is the intent of the Legislature to occupy the whole field of health and safety standards for public swimming pools and the requirements established in this article and the regulations adopted pursuant to this article shall be exclusive of all local health and safety standards relating to public swimming pools.
2. As used in this section, the following words have the following meanings:

- (a) "ANSI/APSP performance standard" means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).
- (b) "ASME/ANSI performance standard" means a standard that is accredited by the American National Standards Institute and published by the American Society of Mechanical Engineers.
- (c) "ASTM performance standard" means a standard that is developed and published by ASTM International.
- (d) "Public swimming pool" means an outdoor or indoor structure, whether in-ground or above-ground, intended for swimming or recreational bathing, including a swimming pool, hot tub, spa, or nonportable wading pool, that is any of the following:
  - (i) Open to the public generally, whether for a fee or free of charge.
  - (ii) Open exclusively to members of an organization and their guests, residents of a multiunit apartment building, apartment complex, residential real estate development, or other multifamily residential area, or patrons of a hotel or other public accommodations facility.
  - (iii) Located on the premises of an athletic club, or public or private school.
- (e) "Qualified individual" means a contractor who holds a current valid license issued by the State of

California or a professional engineer licensed in the State of California who has experience working on public swimming pools.

- (f) "Safety vacuum release system" means a vacuum release system that ceases operation of the pump, reverses the circulation flow, or otherwise provides a vacuum release at a suction outlet when a blockage is detected.
  - (g) "Skimmer equalizer line" means a suction outlet located below the waterline, typically on the side of the pool, and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir. However, a skimmer equalizer line is not a suction outlet for purposes of Subdivisions (4) and (6).
  - (h) "Suction outlet" means a fitting or fixture of a swimming pool that conducts water to a recirculating pump.
  - (i) "Unblockable suction outlet" means a suction outlet, including the sump, that has a perforated (open) area that cannot be shadowed by the area of the 18-inch by 23-inch body blocking element of the ANSI/APSP-16 performance standard, and that the rated flow through any portion of the remaining open area cannot create a suction force in excess of the removal force values in Table 1 of that standard.
3. Subject to Subdivision (6), every public swimming pool shall be equipped with anti-entrapment devices or systems that comply with ANSI/APSP-16 performance standard or successor standard designated by the Federal Consumer Product Safety Commission.
    - a. A public swimming pool that has a suction outlet in any location other than on the bottom of the pool shall be designed so that the recirculation system shall have the capacity to provide a complete turnover of pool water within the following time:
      - (i) One-half hour or less for a spa pool.
      - (ii) One-half hour or less for a spray ground.
      - (iii) One-half hour or less for a wading pool.
      - (iv) Two hours or less for a medical pool.
      - (v) Six hours or less for all other types of public pools.
  4. Subject to Subdivisions (5) and (6), every public swimming pool with a single suction outlet that is not an unblockable suction outlet shall be equipped with at least one or more of the following devices or systems that are designed to prevent physical entrapment by pool drains:
    - (a) A safety vacuum release system that has been tested by a nationally recognized testing laboratory and found to conform to ASME/ANSI Performance Standard A112.19.17, as in effect on December 31, 2009, or ASTM Performance Standard F2387, as in effect on December 31, 2009.



- (b) A suction-limiting vent system with a tamper-resistant atmospheric opening, provided that it conforms to any applicable ASME/ANSI or ASTM performance standard.
  - (c) A gravity drainage system that utilizes a collector tank, provided that it conforms to any applicable ASME/ANSI or ASTM performance standard.
  - (d) An automatic pump shut-off system tested by a department-approved independent third party and found to conform to any applicable ASME/ANSI or ASTM performance standard.
  - (e) Any other system that is deemed, in accordance with federal law, to be equally effective as, or more effective than, the systems described in paragraph (a) at preventing or eliminating the risk of injury or death associated with the circulation system of the pool and suction outlets.
5. Every public swimming pool constructed on or after January 1, 2010, shall have at least two suction outlets per pump that are hydraulically balanced and symmetrically plumbed through one or more "T" fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets. A public swimming pool constructed on or after January 1, 2010, that meets the requirements of this subdivision, shall be exempt from the requirements of Subdivision (4).
6. A public swimming pool constructed prior to January 1, 2010, shall be retrofitted to comply with Subdivisions (3) and (4) by no later than July 1, 2010, except that no further retrofitting is required for a public swimming pool that completed a retrofit between December 19, 2007, and January 1, 2010, that complied with the Virginia Graeme Baker Pool and Spa Safety Act (15 U.S.C. Sec. 8001 et seq.) as in effect on the date of issue of the construction permit, or for a nonportable wading pool that completed a retrofit prior to January 1, 2010, that complied with state law on the date of issue of the construction permit. A public swimming pool owner who meets the exception described in this subdivision shall do one of the following prior to September 30, 2010:
- a. File the form issued by the department pursuant to subdivision (g), as otherwise provided in subdivision (h).
  - b. File a signed statement attesting that the required work has been completed.
  - c. Provide a document containing the name and license number of the qualified individual who completed the required work.
  - d. Provide either a copy of the final building permit, if required by the local agency, or a copy of one of the following documents if no permit was required:
    - (i) A document that describes the modification in a manner that provides sufficient information to document the work that was done to comply with federal law.
    - (ii) A copy of the final paid invoice. The amount paid for the services may be omitted or redacted from the final invoice prior to submission.
7. Prior to March 31, 2010, the department shall issue a form for use by an owner of a public swimming pool to indicate compliance with this section. The department shall consult with county health officers and directors of departments of environmental health in developing the form and shall post the form on the department's Internet Web site. The form shall be completed by the owner of a public swimming pool prior to filing the form with the appropriate city, county, or city and county department of environmental health. The form shall include, but not be limited to, the following information:
- a. A statement of whether the pool operates with a single suction outlet or multiple suction outlets that comply with Subdivision (5).
  - b. Identification of the type of anti-entrapment devices or systems that have been installed pursuant to Subdivision (4) and the date or dates of installation.
  - c. Identification of the type of devices or systems designed to prevent physical entrapment that have been installed pursuant to Subdivision (4) in a public swimming pool with a single suction outlet that is not an unblockable suction outlet and the date or dates of installation or the reason why the requirement is not applicable.
  - d. A signature and license number of a qualified individual who certifies that the factual information provided on the form in response to paragraphs (a) to (c), inclusive, is true to the best of his or her knowledge.
8. A qualified individual who improperly certifies information pursuant to Paragraph (d) of Subdivision (7) shall be subject to potential disciplinary action at the discretion of the licensing authority.
9. Except as provided in Subdivision (6), each public swimming pool owner shall file a completed copy of the form issued by the department pursuant to this section with the city, county, or city and county department of environmental health in the city, county, or city and county in which the swimming pool is located. The form shall be filed within 30 days following the completion of the swimming pool construction or installation required pursuant to this section or, if the construction or installation is completed prior to the date that the department issues the form pursuant to this section, within 30 days of the date that the department issues the form. The public swimming pool owner or operator shall not make a false statement, representation, certification, record, report, or otherwise falsify information that he or she is required to file or maintain pursuant to this section.
10. In enforcing this section, health officers and directors of city, county, or city and county departments of environmental health shall consider documentation filed on or with the form issued pursuant to this section by the owner of a public swimming pool as evidence of compliance with this section. A city, county, or city and county department

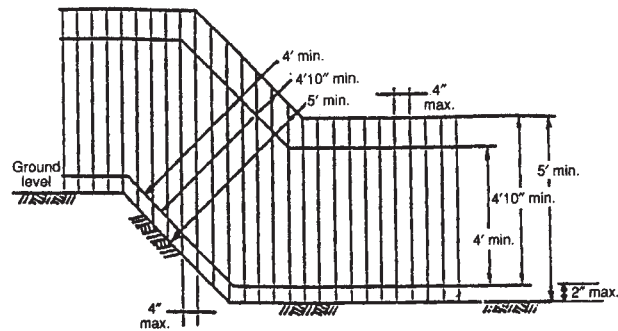
*of environmental health may verify the accuracy of the information filed on or with the form.*

*11.To the extent that the requirements for public wading pools imposed by Section 116064 conflict with this section, the requirements of this section shall prevail.*

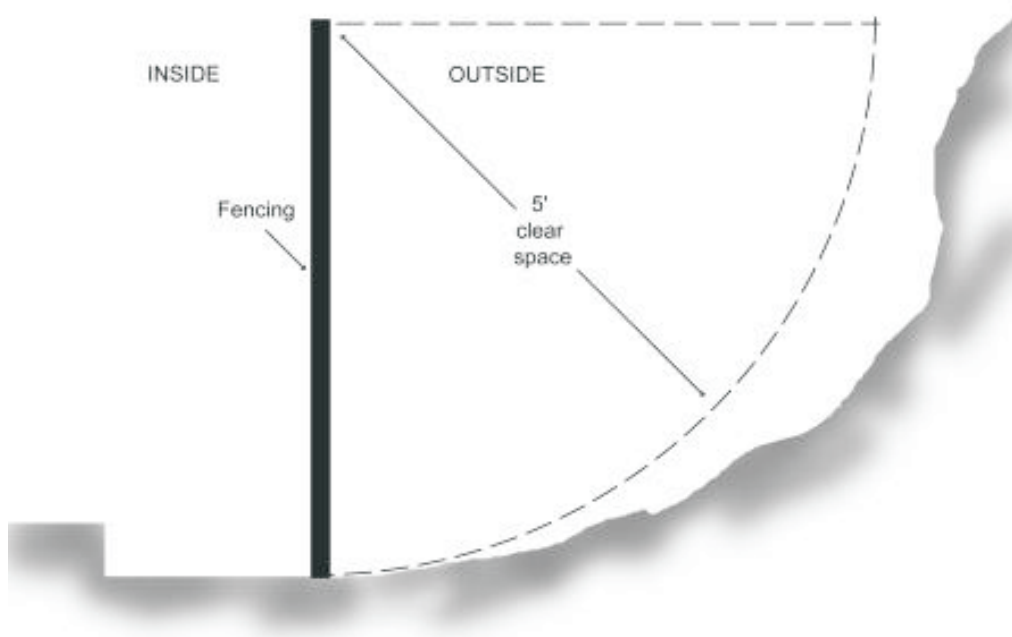
*12.The department shall have no authority to take any enforcement action against any person for violation of this section and has no responsibility to administer or enforce the provisions of this section.*

*Authority: Health and Safety Code Section 116064 (e)*

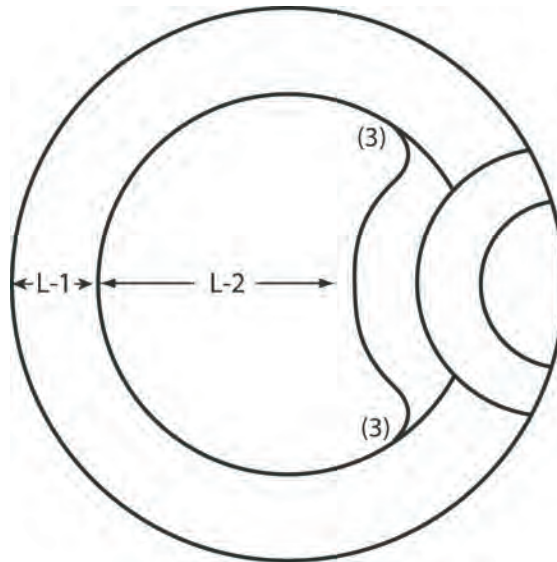
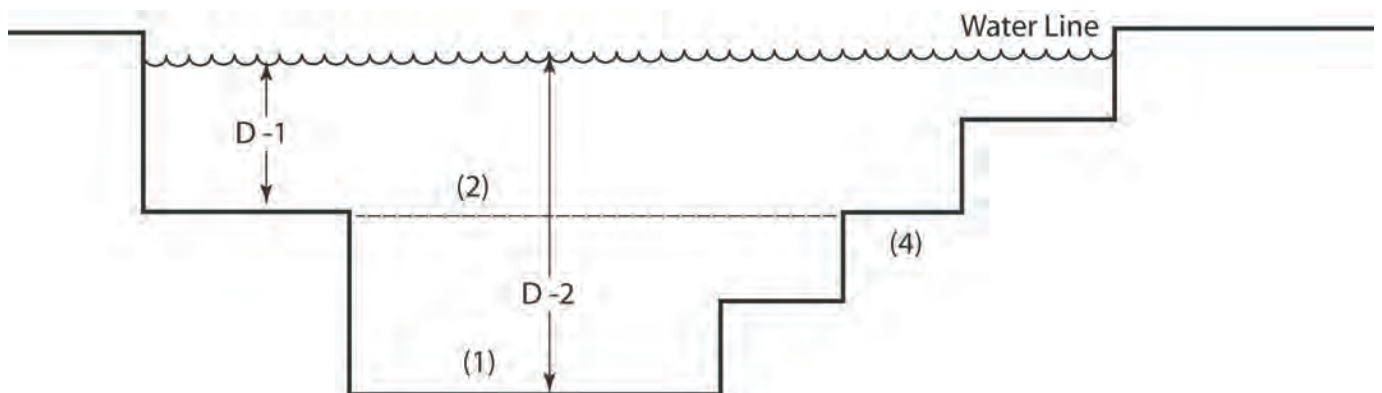
*Reference: Health and Safety Code Section 116064.2 AB 2114, (Statutes 2012, c. 679).*



**FIGURE 31B-4**  
**PERPENDICULAR FENCING DIMENSIONS ON SLOPING GROUND**



**FIGURE 31B-5**  
**EFFECTIVE FENCING HEIGHT**

**TOP VIEW****TRANSVERSE SECTION**

**FIGURE 31B-6**  
**DEPTHS AND DIMENSIONS FOR SPA POOLS**

TABLE 31B-6

Dimension	DEPTH OF WATER		LENGTH OF SECTIONS	
	D1	D2	L1	L2
Minimum	—	24"	12"	24"
Maximum	24"	42"	24"	—

- Notes for Figure 31B-6 and Table 31B-6:
- 1. Bottom slope shall not exceed 1:10 and must be uniform.
  - 2. Bench ramping shall not exceed 1:10 uniform slope, measured at the inner circumference of the bench.
  - 3. Six inch minimum radius at "pinch points."
  - 4. See Sections 3111B and 3112B for step and handrail dimensions.

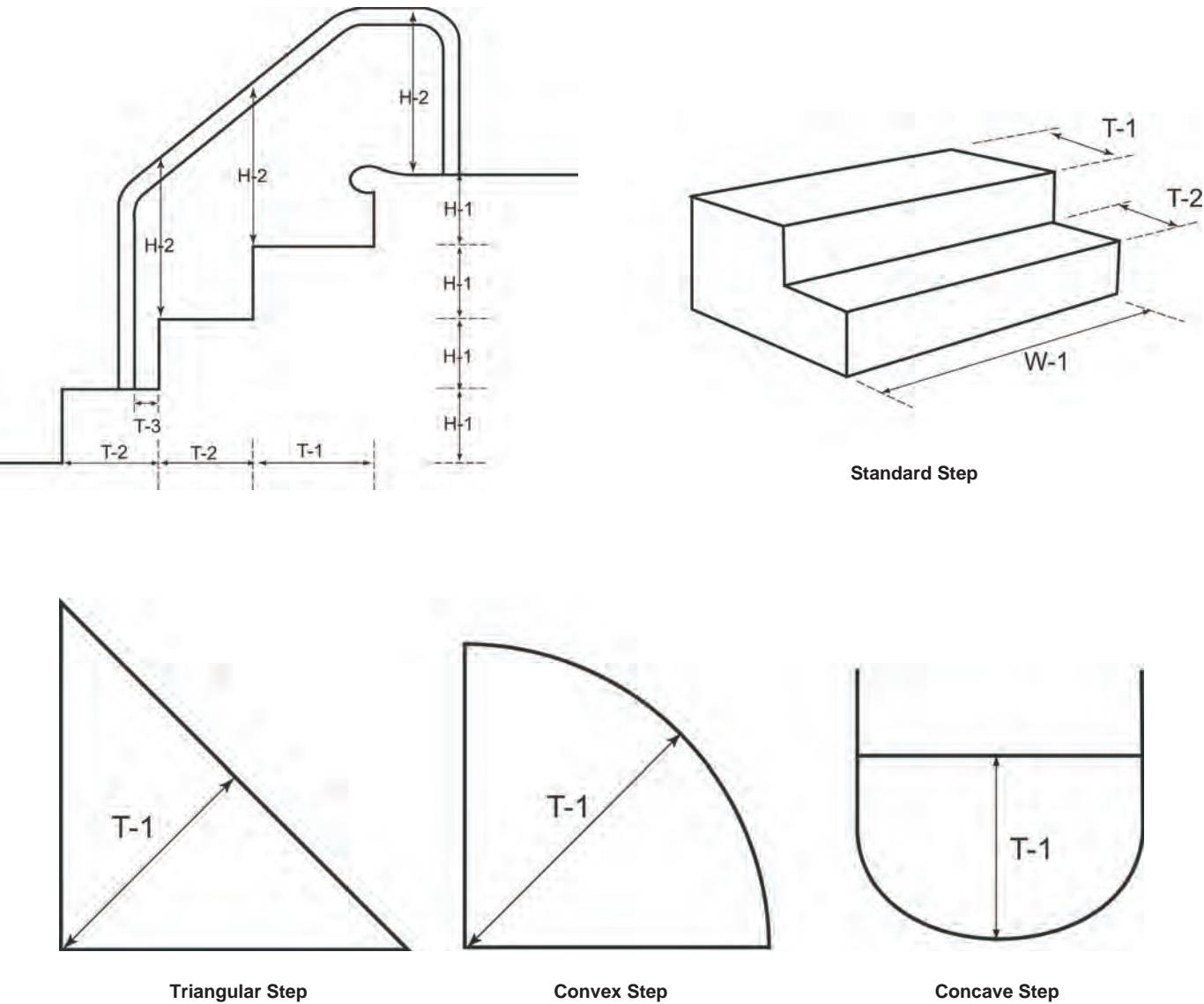


FIGURE 31B-7  
STAIR AND HANDRAIL DIMENSIONS

TABLE 31B-7

<b>DIMENSIONS</b>	<b>T-1 STANDARD</b>	<b>T-1 TRIANGULAR, CONCAVE, CONVEX</b>	<b>T-2</b>	<b>T-3</b>	<b>W-1</b>	<b>H-1</b>	<b>H-2</b>
<i>Minimum</i>	14"	21"	12"	3"	24"	6"	28"
<i>Maximum</i>	18"	24"	16"	—	—	12"	36"



## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 31C – RADIATION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter														X						
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter/Section																				





## CHAPTER 31C [DPH]

### RADIATION

#### SECTION 3101C SCOPE

*For the purpose of this chapter, the following terms shall have the meaning indicated:*

**PRIMARY PROTECTIVE BARRIER** is a barrier to attenuate the useful beam.

**SECONDARY PROTECTIVE BARRIER** is a barrier to attenuate stray radiation.

**STRAY RADIATION** is radiation not serving any useful purpose, which includes leakage and scattered radiation.

**USEFUL BEAM** is the radiation which passes through the window, aperture, cone or other collimating device of the tube housing.

#### SECTION 3102C RADIATION SHIELDING BARRIERS

All radiation shielding barriers in rooms and enclosures housing machines shall meet the requirements of Section 12-31C-101, Chapter 12-31C, Part 12, California Referenced Standards Code. The Department of Health Services is the only agency that may grant a variance or exception to these standards.

#### SECTION 3103C MEDICAL RADIOGRAPHIC AND PHOTOFLUOROGRAPHIC INSTALLATIONS

**3103C.1 Operator station.** The operator's station at the control shall be behind a protective barrier either in a separate room, in a protected booth or behind a shield which will intercept the useful beam and any radiation which has been scattered only once.

**3103C.2 Patient observation and communication.** Provision shall be made for the operator to observe and communicate with the patient without leaving the shielded position at the control panel. When an observation window is used, it must provide radiation attenuation equal to that required in the surrounding barrier.

#### SECTION 3104C MEDICAL THERAPEUTIC X-RAY INSTALLATIONS

**3104C.1 General.** All wall, floor and ceiling areas that can be struck by the useful beam, plus a border of 1 foot (305 mm), shall be provided with primary protective barriers.

**3104C.2 Equipment operating above 50 kVp.** Equipment operating above 50 kVp shall conform with the following:

1. The control station shielding shall either be an integral part of the building or anchored to the building.

2. The control station shall be provided with a window having radiation attenuation equal to that required by the adjacent barrier, or a mirror system, or a closed-circuit television viewing screen. The patient area must be visible to the operator without having to leave the protected area during exposure.

**3104C.3 Equipment operating above 150 kVp.** Equipment operating above 150 kVp shall conform to the following:

1. The treatment room shall be provided with interlocks so that when any door of the treatment room is opened, either the machine will shut off automatically or the radiation level within the room will be reduced to an average of not more than 2 milliroentgens per hour and a maximum of 10 milliroentgens per hour at a distance of one meter in any direction from the target. After such shutoff or reduction in output, it shall be possible to restore the machine to full operation only from the control panel.
2. The control station shall be within a protective booth or in an adjacent room.

**3104C.4** A minimum of one door shall be provided with an auxiliary means for being opened in case of power failure or mechanical breakdown, where large power-driven doors offer the only access to the room.

**3104C.5** A flashing red warning signal light energized only when the useful beam is on shall be located adjacent to the entrance(s) to a therapy room with equipment capable of operating above 500 kVp.



## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 31D – FOOD ESTABLISHMENTS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter														X						
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter/Section																				



## **CHAPTER 31D [DPH]**

# **FOOD ESTABLISHMENTS**

### **SECTION 3101D**

#### **SCOPE**

*The provisions of this chapter shall apply to the construction of commissaries serving mobile food preparation units.*

### **SECTION 3102D**

#### **DEFINITIONS**

*For the purpose of this chapter, the following term shall have the meaning indicated:*

**COMMISSARIES SERVING MOBILE FOOD PREPARATION UNITS** are food establishments in which food, containers, equipment or supplies are stored or handled for use in vehicles, mobile food preparation units, food carts or vending machines.

### **SECTION 3103D**

#### **BUILDINGS AND STRUCTURES**

**3103D.1 Light.** *Ten foot candles (107.6 lux) of uniformly distributed light as measured 30 inches (762 mm) above the floor shall be provided in all rooms and areas in commissaries serving mobile food preparation units.*



**CHAPTER 31E**  
**RESERVED**





## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 31F – MARINE OIL TERMINALS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				X
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter/Section																				



# CHAPTER 31F [SLC] MARINE OIL TERMINALS Division I

## SECTION 3101F [SLC] INTRODUCTION

**3101F.1 General.** The Lempert-Keene-Seastrand oil spill prevention and response act of 1990 (act), as amended, authorized the California State Lands Commission (SLC) to regulate marine oil terminals (MOTs) in order to protect public health, safety and the environment. The authority for this regulation is contained in Sections 8755 and 8756 of the California Public Resources Code. This act defines “oil” as any kind of petroleum, liquid hydrocarbons, or petroleum products or any fraction or residues thereof, including but not limited to, crude oil, bunker fuel, gasoline, diesel fuel, aviation fuel, oil sludge, oil refuse, oil mixed with waste, and liquid distillates from unprocessed natural gas. The provisions of this chapter regulate marine oil terminals as defined under this act.

**3101F.2 Purpose.** The purpose of this code is to establish minimum engineering, inspection and maintenance criteria for MOTs in order to prevent oil spills and to protect public health, safety and the environment. This code does not, in general, address operational requirements. Relevant provisions from existing codes, industry standards, recommended practices, regulations and guidelines have been incorporated directly or through reference, as part of this code.

Where there are differing requirements between this code and/or references cited herein, the choice of application shall be subject to approval of the Marine Facilities Division (Division) of the SLC.

**3101F.3 Applicability.** The provisions of this chapter are applicable to the evaluation of existing MOTs and design of new MOTs in California. Each provision is classified as New (N), Existing (E), or Both (N/E) and shall be applied accordingly. If no classification is indicated, the classification shall be considered to be (N/E).

Existing (E) requirements apply to MOTs that are in operation on the date this code is adopted. For these MOTs, equivalent or in-kind replacement of existing equipment, short pipeline sections, or minor modification of existing components shall also be subject to the existing (E) requirements.

New (N) requirements apply to:

1. A MOT or berthing system (Subsection 3102F.1.3) that commences or recommences operation with a new or modified operations manual after adoption of this code.
2. Addition of new structural components or systems at an existing MOT that are structurally independent of existing components or systems.
3. Addition of new (nonreplacement) equipment, piping, pipelines, components or systems to an existing MOT.
4. Major repairs or substantially modified in-place systems.
5. Any associated major installations or modifications.

**3101F.4 Overview.** This Code ensures that a MOT can be safely operated within its inherent structural and equipment-related constraints.

Section 3102F defines minimum requirements for audit, inspection and evaluation of the structural, electrical and

mechanical systems on a prescribed periodic basis, or following a significant, potentially damage-causing event.

Section 3103F, 3104F and 3107F provide criteria for structural loading, deformation and performance-based evaluation considering earthquake, wind, wave, current, seiche and tsunami effects.

Section 3105F provides requirements for the safe mooring and berthing of tank vessels and barges.

Section 3106F describes requirements for geotechnical hazards and foundation analyses, including consideration of slope stability and soil failure.

Section 3108F provides requirements for fire prevention, detection and suppression including appropriate water and foam volumes.

Sections 3109F through 31011F provide requirements for piping/pipelines, mechanical and electrical equipment and electrical systems.

English units are prescribed herein; however, many of the units in the references are in System International (SI).

**3101F.5 Risk reduction strategies.** Risk reduction strategies, such as pipeline segmentation devices, system flexibility and spill containment devices may be used to reduce the size of a potential oil spill. Such strategies may reduce the MOT risk classification as determined from Table 31F-4-1.

### 3101F.6 Review requirements.

**3101F.6.1 Quality assurance.** All audits, inspections, engineering analyses or design shall be reviewed by a professional having similar or higher qualifications as the person who performed the work, to ensure quality assurance. This review may be performed in-house.

Peer review is required for nonlinear dynamic structural analyses and alternative lateral force procedures not prescribed herein. The peer review may be from an independent internal or external source. The peer reviewer shall be a California registered civil or structural engineer.

**3101F.6.2 Division review.** The following will be subject to review for compliance with this code by the Division or its authorized representative(s):

1. Any audit, inspection, analysis or evaluation of MOTs.
2. Any significant change, modification or re-design of a structural, mooring, fire, piping/pipelines, mechanical or electrical system at an MOT, prior to use or reuse.
3. Engineering analysis and design for any new MOT prior to construction. Also see Section 3102F.3.3.1.
4. Construction inspection team and the construction inspection report(s).

Authority: Sections 8755 and 8757, Public Resources Code.  
Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

**3101F.7 Alternatives.** In special circumstances where certain requirements of these standards cannot be met, alternatives that provide an equal or better protection of the public health, safety and the environment shall be subject to Division Chief approval with concurrence of the Division's lead engineer in responsible charge.

## Division 2

SECTION 3102F  
AUDIT AND INSPECTION

## 3102F.1 General.

**3102F.1.1 Purpose.** Section 3102F defines minimum requirements for audit, inspection, and evaluation of the structural, mechanical and electrical components and systems.

**3102F.1.2 Audit and inspections types.** The audit and inspections described in this Chapter (31F) and 2 CCR 2320 (a) and (b) [2.1] are:

1. Annual inspection
2. Audit
3. Post-event inspection

Each has a distinct purpose and is conducted either at a defined interval (see Table 31F-2-1 and Section 3102F.3.3.2), as a result of a significant, potentially damage-causing event or a significant change in operations. In the time between audits and inspections, operators are expected to conduct periodic walk-down examinations of the MOT to detect potentially unsafe conditions.

**3102F.1.3 Berthing systems.** For the purpose of assigning structural ratings and documenting the condition of mechanical and electrical systems, an MOT shall be divided into independent “berthing systems.” A berthing system consists of the wharf and supporting structure, mechanical and electrical components that serve the berth and pipeline systems as defined in Title 2 CCR §2560 and 2561(n).

For example, a MOT consisting of wharves with three berths adjacent to the shoreline could contain three independent “berthing systems” if the piping does not route through adjacent berths. Therefore, a significant defect that would restrict the operation of one berth would have no impact on the other two berths. Conversely, if a T-head Pier, with multiple berths sharing a trestle that supports all piping to the shoreline, had a significant deficiency on the common trestle, the operation of all berths could be adversely impacted. This configuration is classified as a single berthing system.

The physical boundaries of a berthing system may exclude unused sections of a structure. Excluded sections must be physically isolated from the berthing system. Expansion joints may provide this isolation.

**3102F.1.4 Records.** All MOTs shall have records reflecting current, as-built conditions for all berthing systems. Records shall include, but not be limited to modifications and/or replacement of structural components, electrical or mechanical equipment or relevant operational changes, new construction including design drawings, calculations, engineering analyses, soil borings, equipment manuals, specifications, shop drawings, technical and maintenance manuals and documents.

Chronological records and reports of annual inspections, audits and post-event inspections and documentation of equipment or structural changes shall be maintained.

Records shall be indexed and be readily accessible to the Division (see 2 CCR Section 2320 (c) (2)) [2.1].

**3102F.1.5 Baseline inspection.** If “as-built” or subsequent modification drawings are not available, incomplete or inaccurate, a baseline inspection is required to gather data in sufficient detail for adequate evaluation.

The level of detail required shall be such that structural member sizes, connection and reinforcing details are documented, if required in the structural analysis. In addition, the strength and/or ductility characteristics of construction materials shall be determined, as appropriate. Nondestructive testing, partially destructive testing and/or laboratory testing methods may be used.

All fire, piping, mechanical and electrical systems shall be documented as to location, capacity, operating limits and physical conditions.

**3102F.2 Annual inspection.** The annual inspection required by 2 CCR 2320 (a)(1) [2.1], may include an engineering examination of the topside and underside areas of the dock, including the splash zone. The Division shall perform the inspection, with cooperation from the owner/operator. Observations will be recorded and a report of violations and deficiencies shall be provided to the operator.

Subject to operating procedures, a boat shall be provided to facilitate the inspection of the dock undersides and piles down to the splash zone. If a boat is not available or the under dock inspection cannot be performed by the Division during the annual inspection, the MOT operator shall carry out or cause to be carried out, such an inspection. The operator will then provide the Division with a report detailing the examination results including photographs, videos and sketches as necessary to accurately depict the state of the underside of the dock.

## 3102F.3 Audits.

**3102F.3.1 Objective.** The objective of the audit is to review structural, mechanical and electrical systems on a prescribed periodic basis to verify that each berthing system is fit for its specific defined purpose. The audit includes above water and underwater inspections, engineering evaluation, documentation and recommended follow-up actions.

**3102F.3.2 Overview.** The audit shall include above water and underwater inspections, and structural, electrical and mechanical systems evaluations, with supporting documentation, drawings and follow-up actions. Structural systems shall include seismic, operational, mooring, berthing and geotechnical considerations. Mechanical systems shall include fire, piping/pipelines and mechanical equipment considerations. The audit is performed by a multi-disciplinary team of engineers, qualified inspectors and may include Division representatives.

The above water inspection involves an examination of all structural, mechanical and electrical components above the waterline. Structural defects and their severity shall be documented, but the exact size and location of each deficiency is typically not required.



The underwater inspection involves an examination of all structural, mechanical and electrical components below the waterline. A rational and representative underwater sampling of piles may be acceptable with Division approval, for cases of limited visibility, heavy marine growth, restricted inspection times because of environmental factors (currents, water temperatures, etc.) or a very large number of piles.

Global operational structural assessment rating(s) (OSAR), global seismic structural assessment rating(s) (SSAR) and global inspection condition assessment rating(s) (ICAR) shall be assigned to each structure and overall berthing system, where appropriate (Table 31F-2-4).

Remedial action priorities (RAP) shall be assigned for component deficiencies (Table 31F-2-5). Recommendations for remediation and/or upgrading shall be prescribed as necessary.

An audit is not considered complete until the audit report is received by the Division.

### 3102F.3.3 Schedule.

**3102F.3.3.1 Initial audit.** For a new MOT or new berthing system(s), the initial audit of the “as-built” systems(s) shall be performed prior to commencement of operations.

**3102F.3.3.2 Subsequent audits.** A subsequent audit report of each terminal shall be completed at a maximum interval of 4 years, and includes documentation of inspections. This interval may be reduced, based on the recommendation of the audit team leader, and with the approval of the Division, depending on the extent and rate of deterioration or other factors.

The maximum interval for above water inspections shall be 4 years. The maximum interval for underwater inspections is dependent upon the condition of the facility, the construction material type and/or the environment at the mudline, as shown in Table 31F-2-1.

If there are no changes in the defined purpose (see Section 3102F.3.6.1) of the berthing system(s), then analyses from previous audits may be referenced. However, if there is a significant change in a berthing system(s), or when deterioration or damage must be considered, a new analysis may be required.

The Division may require an audit, inspection or supplemental evaluations to justify changes in the use of the berthing system(s).

### 3102F.3.4 Audit team.

**3102F.3.4.1 Project manager.** The audit shall be conducted by a multidisciplinary team under the direction of a project manager representing the MOT. The project manager shall have specific knowledge of the MOT and may serve other roles on the audit team.

**3102F.3.4.2 Audit team leader.** The audit team leader shall lead the on-site audit team and shall be responsible for directing field activities, including the inspection of all structural, mechanical and electrical systems. The team

leader shall be a California registered civil or structural engineer and may serve other roles on the audit team.

**3102F.3.4.3 Structural inspection team.** The structural inspection shall be conducted under the direction of a registered civil or structural engineer.

All members of the structural inspection team shall be graduates of a 4-year civil/structural engineering, or closely related (ocean/coastal) engineering curriculum, and shall have been certified as an Engineer-in-Training; or shall be technicians who have completed a course of study in structural inspections. The minimum acceptable course in structural inspections shall include 80 hours of instruction specifically related to structural inspection, followed by successful completion of a comprehensive examination. An example of an acceptable course is the U.S. Department of Transportation’s “Safety Inspection of In-Service Bridges.” Certification as a Level IV Bridge Inspector by the National Institute of Certification in Engineering Technologies (NICET) shall also be acceptable [2.2].

For underwater inspections, the registered civil or structural engineer directing the underwater structural inspection shall also be a commercially trained diver or equivalent and shall actively participate in the inspection, by personally conducting a minimum of 25 percent of the underwater examination [2.2].

Each underwater team member shall also be a commercially trained diver, or equivalent. Divers performing manual tasks such as cleaning or supporting the diving operation, but not conducting or reporting on inspections, may have lesser technical qualifications [2.2].

**3102F.3.4.4 Structural analyst.** A California registered civil or structural engineer shall be in responsible charge of the structural evaluations.

**3102F.3.4.5 Electrical inspection team.** A registered electrical engineer shall direct the on-site team performing the inspection and evaluation of electrical components and systems.

**3102F.3.4.6 Mechanical inspection team.** A registered engineer shall direct the on-site team performing the inspection and evaluation of piping/pipeline, mechanical and fire components and systems, except the Fire Protection Assessment in accordance with Section 3108F.2.2.

**3102F.3.4.7 Divisional representation.** The Division representative(s) may participate in any audit or inspection as observer(s) and may provide guidance.

**3102F.3.4.8 Geotechnical analyst.** A California registered civil engineer with a California authorization as a geotechnical engineer shall perform the geotechnical evaluation required for the audit and all other geotechnical evaluations.

### 3102F.3.5 Scope of inspections.

**3102F.3.5.1 Above water structural inspection.** The above water inspection shall include all accessible components above +3 ft MLLW. Accessible components shall

be defined as those components above and below deck that are reachable without the need for excavation or extensive removal of materials that may impair visual inspection. The above water inspection shall include, but not be limited to, the following:

1. Piles
2. Pile caps
3. Beams
4. Deck soffit
5. Bracing
6. Retaining walls and bulkheads
7. Connections
8. Seawalls
9. Slope protection
10. Deck topsides and curbing
11. Expansion joints
12. Fender system components
13. Dolphins and deadmen
14. Mooring points and hardware
15. Navigation aids
16. Platforms, ladders, stairs, handrails and gangways
17. Backfill (sinkholes/differential settlement)

**3102F.3.5.2 Underwater structural inspection.** The underwater inspection shall include all accessible components from +3 ft MLLW to the mudline, including the slope and slope protection, in areas immediately surrounding the MOT. The water depth at the berth(s) shall be evaluated,

verifying the maximum or loaded draft specified in the MOT's Operations Manual (2 CCR 2385 (d)) [2.1].

The underwater structural inspection shall include the Level I, II and III inspection efforts, as shown in Tables 31F-2-2 and 31F-2-3. The underwater inspection levels of effort are described below, per [2.2]:

**Level I**—Includes a close visual examination, or a tactile examination using large sweeping motions of the hands where visibility is limited. Although the Level I effort is often referred to as a “swim-by” inspection, it must be detailed enough to detect obvious major damage or deterioration due to overstress or other severe deterioration. It should confirm the continuity of the full length of all members and detect undermining or exposure of normally buried elements. A Level I effort may also include limited probing of the substructure and adjacent channel bottom.

**Level II**—A detailed inspection which requires marine growth removal from a representative sampling of components within the structure. For piles, a 12-inch high band should be cleaned at designated locations, generally near the low waterline, at the mud-line, and midway between the low waterline and the mudline. On a rectangular pile, the marine growth removal should include at least three sides; on an octagon pile, at least six sides; on a round pile, at least three-fourths of the perimeter. On large diameter piles, 3 ft or greater, marine growth removal should be effected on 1 ft by 1 ft areas at four locations approximately equally spaced around the perimeter, at each elevation. On large solid faced elements such as retaining structures, marine growth removal should be effected on 1 ft by 1 ft areas at the three specified elevations. The inspection should also focus on typical areas of weakness, such as attachment points and welds. The Level II effort is

**TABLE 31F-2-1  
MAXIMUM INTERVAL BETWEEN UNDERWATER INSPECTIONS (YEARS)<sup>1</sup>**

INSPECTION CONDITION ASSESSMENT RATING (ICAR) <sup>6</sup>	CONSTRUCTION MATERIAL				CHANNEL BOTTOM OR MUDLINE—SCOUR <sup>d</sup>	
	Unwrapped Timber or Unprotected Steel (no coating or cathodic protection) <sup>4</sup>		Concrete, Wrapped Timber, Protected Steel or Composite Materials (FRP, plastic, etc.) <sup>4</sup>			
	Benign <sup>2</sup> Environment	Aggressive <sup>3</sup> Environment	Benign <sup>2</sup> Environment	Aggressive <sup>3</sup> Environment	Benign <sup>2</sup> Environment	Aggressive <sup>3</sup> Environment
6 (Good)	6	4	6	5	6	5
5 (Satisfactory)	6	4	6	5	6	5
4 (Fair)	5	3	5	4	6	5
3 (Poor)	4	3	5	4	6	5
2 (Serious)	2	1	2	2	2	2
1 (Critical)	N/A <sup>5</sup>	N/A <sup>5</sup>	N/A <sup>5</sup>	N/A <sup>5</sup>	N/A <sup>5</sup>	N/A <sup>5</sup>

1. The maximum interval between Underwater Inspections shall be changed as appropriate, with the approval of the Division, based on the extent of deterioration observed on a structure, the rate of further anticipated deterioration or other factors.
2. Benign environments include fresh water and maximum current velocities less than 1.5 knots for the majority of the days in a calendar year.
3. Aggressive environments include brackish or salt water, polluted water, or waters with current velocities greater than 1.5 knots for the majority of the days in the calendar year.
4. For most structures, two maximum intervals will be shown in this table, one for the assessment of construction material (timber, concrete, steel, etc.) and one for scour (last 2 columns). The shorter interval of the two should dictate the maximum interval used.
5. MOTs rated “Critical” will not be operational; and Emergency Action shall be required in accordance with Table 31F-2-6.
6. ICARs shall be assigned in accordance with Table 31F-2-4.

**TABLE 31F-2-2  
UNDERWATER INSPECTION LEVELS OF EFFORT [2.2]**

LEVEL	PURPOSE	DETECTABLE DEFECTS			
		Steel	Concrete	Timber	Composite
I	General visual/tactile inspection to confirm as-built condition and detect severe damage	Extensive corrosion, holes Severe mechanical damage	Major spalling and cracking Severe reinforcement corrosion Broken piles	Major loss of section Broken piles and bracings Severe abrasion or marine borer attack	Permanent deformation Broken piles Major cracking or mechanical damage
II	To detect surface defects normally obscured by marine growth	Moderate mechanical damage Corrosion pitting and loss of section	Surface cracking and spalling Rust staining Exposed reinforcing steel and/or prestressing strands	External pile damage due to marine borers Splintered piles Loss of bolts and fasteners Rot or insect infestation	Cracking Delamination Material degradation
III	To detect hidden or interior damage, evaluate loss of cross-sectional area, or evaluate material homogeneity	Thickness of material Electrical potentials for cathodic protection	Location of reinforcing steel Beginning of corrosion of reinforcing steel Internal voids Change in material strength	Internal damage due to marine borers (internal voids) Decrease in material strength	N/A

**TABLE 31F-2-3  
SCOPE OF UNDERWATER INSPECTIONS [2.2]**

LEVEL		SAMPLE SIZE AND METHODOLOGY <sup>1</sup>							
		Steel		Concrete		Timber		Composite	Slope Protection, Channel Bottom or Mudline-Scour
		Piles	Bulkheads/Retaining Walls	Piles	Bulkheads/Retaining Walls	Piles	Bulkheads/Retaining Walls	Piles	
I	Sample Size: 100% Method: Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile
II	Sample Size: 10% Method: Visual: Removal of marine growth in 3 bands	10% Visual: Removal of marine growth in 3 bands	Every 100 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth in 3 bands	Every 100 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth on 3 bands Measurement: Remaining diameter	Every 50 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth in 3 bands	0%
III	Sample Size: 5% Method: Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	5% Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	Every 200 LF Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	0% N/A	0% N/A	5% Internal marine borer infestation evaluation	Every 100 LF Internal marine borer infestation evaluation	0%	0%

1. The minimum inspection sampling size for small structures shall include at least two components.

LF = Linear Feet; SF = Square Feet; N/A = Not Applicable

intended to detect and identify damaged and deteriorated areas that may be hidden by surface biofouling. The thoroughness of marine growth removal should be governed by what is necessary to discern the condition of the underlying structural material. Removal of all biofouling staining is generally not required.

Level III—A detailed inspection typically involving nondestructive or partially-destructive testing, conducted to detect hidden or interior damage, or to evaluate material homogeneity. Level III testing is generally limited to key structural areas, areas which are suspect or areas which may be representative of the underwater structure.

### 3102F.3.5.3 Special inspection considerations.

**3102F.3.5.3.1 Coated components.** For coated steel components, Level I and Level II efforts should focus on the evaluation of the integrity and effectiveness of the coating. The piles should be inspected without damaging the coating. Level III efforts should include ultrasonic thickness measurements without removal of the coating, where feasible.

**3102F.3.5.3.2 Encased components.** For steel, concrete or timber components that have been encased, the Level I and II efforts should focus on the evaluation of the integrity of the encasement. If evidence of signifi-



cant damage to the encasement is present, or if evidence of significant deterioration of the underlying component is present, then the damage evaluation should consider whether the encasement was provided for protection and/or structural capacity. Encasements should not typically be removed for an audit.

For encasements on which the formwork has been left in place, the inspection should focus on the integrity of the encasement, not the formwork. Level I and Level II efforts in such cases should concentrate on the top and bottom of the encasement. For concrete components, if deterioration, loss of bonding, or other significant problems with the encasement are suspected, it may be necessary to conduct a special inspection, including coring of the encasement and laboratory evaluation of the materials.

**3102F.3.5.3 Wrapped components.** For steel, concrete or timber components that have been wrapped, the Level I and II efforts should focus on the evaluation of the integrity of the wrap. Since the effectiveness of a wrap may be compromised by removal, and since the removal and re-installation of wraps is time-consuming, it should not be routinely done. However, if evidence of significant damage exists, or if the effectiveness of the wraps is in question, then samples should be removed to facilitate the inspection and evaluation. The samples may be limited to particular zones or portions of members if damage is suspected, based on the physical evidence of potential problems. A minimum sample size of three members should be used. A five-percent sample size, up to 30 total members, may be adequate as an upper limit.

For wrapped timber components, Level III efforts should consist of removal of the wraps from a representative sample of components in order to evaluate the condition of the timber beneath the wrap. The sample may be limited to particular zones or portions of the members if damage is suspected (e.g., at the mudline/bottom of wrap or in the tidal zone). The sample size should be determined based on the physical evidence of potential problems and the aggressiveness of the environment. A minimum sample size of three members should be used. A five-percent sample size, up to 30 total members, may be adequate as an upper limit.

**3102F.3.5.4 Mechanical and electrical inspections.** The mechanical and electrical inspections shall include but not be limited to the following:

1. Loading arms
2. Cranes and lifting equipment, including cables
3. Piping/manifolds and supports
4. Oil transfer hoses
5. Fire detection and suppression systems
6. Vapor control system
7. Sumps/sump tanks
8. Vent systems

9. Pumps and pump systems
10. Lighting
11. Communications equipment
12. Gangways
13. Electrical switches and junction boxes
14. Emergency power equipment
15. Air compressors
16. Meters
17. Cathodic protection systems
18. Winches
19. ESD and other control systems
20. Ladders

All alarms, limit switches, load cells, current meters, anemometers, leak detection equipment, etc., shall be operated and/or tested to the extent feasible, to ensure proper function.

### **3102F.3.6 Evaluation and assessment.**

**3102F.3.6.1 Terminal operating limits.** The physical boundaries of the facility shall be defined by the berthing system operating limits, along with the vessel size limits and environmental conditions.

The audit shall include a "Statement of Terminal Operating Limits," which must provide a concise statement of the purpose of each berthing system in terms of operating limits. This description must at least include, the minimum and maximum vessel sizes, including Length Overall (LOA), beam, and maximum draft with associated displacement (see Fig. 31F-2-1).

In establishing limits for both the minimum and maximum vessel sizes, due consideration shall be given to water depths, dolphin spacing, fender system limitations, manifold height and hose/loading arm reach, with allowances for tidal fluctuations, surge and drift.

Maximum wind, current or wave conditions, or combinations thereof, shall be clearly defined as limiting conditions for vessels at each berth, both with and without active product transfer.

**3102F.3.6.2 Mooring and berthing.** Mooring and berthing analyses shall be performed in accordance with Section 3105F. The analyses shall be consistent with the terminal operating limits and the structural configuration of the wharf and/or dolphins and associated hardware.

Based on inspection results, analyses and engineering judgment, mooring and berthing OSARs shall be assigned on a global basis, independently for each structure and overall berthing system. The OSARs defined in Table 31F-2-4 shall be used for this purpose. The mooring and berthing OSARs document the berthing system(s) fitness-for-purpose.

**3102F.3.6.3 Structure.** A structural evaluation, including a seismic analysis, shall be performed in accordance with Sections 3103F through 3107F. Such evaluation

shall consider local or global reduction in capacity, as determined from the inspection.

Based on inspection results, structural analyses and engineering judgment, OSARs (for operational loading) and SSARs shall be assigned on a global basis, independently for each structure, structural system(s) and berthing system(s), as appropriate. The OSARs and SSARs defined in Table 31F-2-4 shall be used for this purpose and document the structural and/or berthing system(s) fitness-for-purpose.

Based on inspection results and engineering judgment, ICARs shall be assigned on a global basis, independently for each above and underwater structure, structural system and berthing system, as appropriate. The ICARs defined in Table 31F-2-4 shall be used for this purpose.

Structural component deficiencies assigned RAPs as per Table 31F-2-5 shall be considered in the OSARs, SSARs and ICARs. The assigned ratings shall remain in effect until all the significant corrective action has been completed to the satisfaction of the Division, or until completion of the next audit.

**3102F.3.6.4 Mechanical and electrical systems.** An evaluation of all mechanical and electrical systems and components shall be performed in accordance with Sections 3108F through 3111F of these standards. If a pipeline stress analysis is required (see Section 3109F.3), forces and imposed seismic displacements resulting from the structural analysis shall be considered. Mechanical and electrical component deficiencies shall be assigned ratings from Table 31F-2-5.

**3102F.3.7 Follow-up actions.** Follow-up actions as described in Table 31F-2-6 shall be prescribed. Multiple follow-up actions may be assigned; however, guidance shall be provided as to the order in which the follow-up actions should be carried out.

If an assessment rating of “1”, “2” or “3” (Table 31F-2-4) or a RAP of “P1” or “P2” (Table 31F-2-5) or “Emergency Action” using Table 31F-2-6, is assigned to a structure, berthing system or critical component, the Division shall be notified immediately. The Executive Summary Table ES-2 (see Example Table 31F-2-8) shall include implementation schedules for all follow-up and remedial actions. Follow-up and remedial actions and implementation schedules are subject to Division approval. Executive Summary Tables shall be maintained and updated by the MOT, and shall be submitted in the audit and/or upon Division request. For action plan implementation, see Section 3102F.3.9.

**3102F.3.8 Documentation and reporting.** The audit reports shall be signed and stamped by the audit team leader. The inspection and other reports and drawings shall be signed and stamped by the engineers in responsible charge.

Each audit and inspection, whether partial or complete, shall be adequately documented. Partial inspections cover only specific systems or equipment examined. The resulting

reports shall summarize and reference relevant previous ratings and deficiencies. Inspection reports shall be included in subsequent audits.

The contents of the audit and inspection reports for each berthing system shall, at a minimum, include the following as appropriate:

**Executive summary**—a concise narrative of the audit or inspection results and analyses conclusions. It shall include summary information for each berthing system, including an overview of the assigned follow-up actions. The Executive Summary Tables shall also be included (see Example Tables 31F-2-7A through 31F-2-7C and 31F-2-8).

#### **Table of contents**

**Introduction**—a brief description of the purpose and scope of the audit or inspection, as well as a description of the inspection/evaluation methodology used.

**Existing conditions**—a description, along with a summary, of the observed conditions. Subsections shall be used to describe the above water structure, underwater structure, fire, piping/pipeline, mechanical and electrical systems, to the extent each are included in the scope of the audit. Photos, plan views and sketches shall be utilized as appropriate to describe the structure and the observed conditions. Details of the inspection results such as test data, measurements data, etc., shall be documented in an appendix.

**Evaluation and assessment**—assessment ratings shall be assigned to all structures and/or berthing systems. Also, see Section 3102F.3.6. All supporting calculations, as-built drawings and documentation shall be included in appendices as appropriate to substantiate the ratings. However, the results and recommendations of the engineering analyses shall be included in this section. Component deficiencies shall be described and a corresponding RAP assigned.

**Follow-up actions**—Specific follow-up actions (Table 31F-2-6) shall be documented (Table 31F-2-8), and remedial schedules included, for each audited system. Audit team leaders shall specify which follow-up actions require a California registered engineer to certify that the completion is acceptable.

**Appendices**—When appropriate, the following appendices shall be included:

1. Background data on the terminal - description of the service environment (wind/waves/currents), extent and type of marine growth, unusual environmental conditions, etc.
2. Inspection/testing data
3. Mooring and berthing analyses
4. Structural and seismic analyses and calculations
5. Geotechnical report
6. MOT Fire Protection Assessment
7. Pipeline stress and displacement analyses

8. Mechanical and electrical system documentation

9. Corrosion assessment

10. Photographs, sketches and supporting data shall be included to document typical conditions and referenced deficiencies, and to justify the assessment ratings and the remedial action priorities RAPs assigned.

**3102F.3.9 Action plan implementation report.** After implementation of remedial measures, a report shall be submitted to the Division and shall include:

1. A description of each action taken

2. Updated Executive Summary Tables

3. Supporting documentation with calculations and/or relevant data

**3102F.4 Post-event inspection.** A post-event inspection is a focused inspection following a significant, potentially damage-causing event such as an earthquake, storm, vessel impact, fire, explosion or tsunami. The primary purpose is to assess the integrity of structural, mechanical and electrical systems. This assessment will determine the operational status and/or any remedial measures required.

**TABLE 31F-2-4  
ASSESSMENT RATINGS**

RATING		DESCRIPTION OF STRUCTURE(S) AND/OR SYSTEMS <sup>4</sup>	
		OSAR <sup>1</sup> and SSAR <sup>2</sup>	ICAR <sup>3</sup>
6	Good	The capacity of the structure or system meets the requirements of this standard. The structure or system should be considered fit-for-purpose. No repairs or upgrades are required.	No problems or only minor problems noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs or upgrades are required.
5	Satisfactory	The capacity of the structure or system meets the requirements of this standard. The structure or system should be considered fit-for-purpose. No repairs or upgrades are required.	Limited minor to moderate defects or deterioration observed, but no overstressing observed. No repairs or upgrades are required.
4	Fair	The capacity of the structure or system is no more than 15 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system should be considered as marginal. Repair and/or upgrade measures may be required to remain operational. Facility may remain operational, provided a plan and schedule for remedial action is presented to and accepted by the Division.	All primary structural elements are sound, but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present, but do not significantly reduce the load bearing capacity of the structure. Repair and/or upgrade measures may be required to remain operational. Facility may remain operational, provided a plan and schedule for remedial action is presented to and accepted by the Division.
3	Poor	The capacity of the structure or system is no more than 25 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system is not fit-for-purpose. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.	Advanced deterioration or overstressing observed on widespread portions of the structure, but does not significantly reduce the load bearing capacity of the structure. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.
2	Serious	The capacity of the structure or system is more than 25 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system is not fit-for-purpose. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.	Advanced deterioration, overstressing or breakage may have significantly affected the load bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.
1	Critical	The capacity of the structure or system is critically deficient relative to the requirements of this standard. The structure or system is not fit-for-purpose. The facility shall cease operations until deficiencies are corrected and accepted by the Division.	Very advanced deterioration, overstressing or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur and load restrictions should be implemented as necessary. The facility shall cease operations until deficiencies are corrected and accepted by the Division.

1. OSAR = Operational Structural Assessment Ratings

2. SSAR = Seismic Structural Assessment Ratings

3. ICAR = Inspection Condition Assessment Ratings [2.2]; Ratings shall be assigned comparing the observed condition to the original condition.

4. Structural, mooring or berthing systems



**3102F.4.1 Notification and action plan.** Notification as per 2 CCR 2325(e) [2.1] shall be provided to the local area Division field office. The notification shall include, as a minimum:

1. Brief description of the event
2. Brief description of the nature, extent and significance of any damage observed as a result of the event
3. Operational status and any required restrictions
4. Statement as to whether a Post-Event inspection will be carried out

The Division may carry out or cause to be carried out, a post-event inspection. In the interim, the Division may direct a change in the operations manual, per 2 CCR 2385 (f)(3) [2.1].

If a post-event inspection is required, an action plan shall be submitted to the Division within five (5) days after the event. This deadline may be extended in special circumstances. The action plan shall include the scope of the inspection (above water, underwater, electrical, mechanical systems, physical limits, applicable berthing systems, etc.) and submission date of the final report. The action plan is subject to Division approval.

**3102F.4.2 Inspection team.** The qualifications of the inspection team shall be the same as those prescribed in Section 3102F.3.4. Division representatives may participate in any post-event inspection, as observers, and may provide guidance.

**3102F.4.3 Scope.** The post-event inspection shall focus on the possible damage caused by the event. General observations of long-term or preexisting deterioration such as significant corrosion-related damage or other deterioration should be made as appropriate, but should not be the focus of the inspection. The inspection shall always include an above-water assessment of structural, mechanical and electrical components.

The inspection team leader shall determine the need for, and methodology of, an underwater structural assessment, in consultation with the Division. Above water observations, such as shifting or differential settlement, misalignments, significant cracking or spalling, bulging, etc., shall be used to determine whether or not an underwater assessment is required. Similarly, the inspection team leader shall determine, in consultation with the Division, the need for,

**TABLE 31F-2-5  
COMPONENT DEFICIENCY REMEDIAL ACTION PRIORITIES (RAP)**

REMEDIAL PRIORITIES	DESCRIPTION AND REMEDIAL ACTIONS
P1	Specified whenever a condition that poses an immediate threat to public health, safety or the environment is observed. <u>Emergency actions</u> may consist of barricading or closing all or portions of the berthing system, evacuating product lines and ceasing transfer operations. <u>The berthing system is not fit-for-purpose. Immediate remedial actions are required prior to the continuance of normal operations.</u>
P2	Specified whenever defects or deficiencies pose a potential threat to public health, safety and the environment. Actions may consist of limiting or restricting operations until remedial measures have been completed. <u>The berthing system is not fit-for-purpose. This priority requires investigation, evaluation and urgent action.</u>
P3	Specified whenever systems require upgrading in order to comply with the requirement of these standards or current applicable codes. These deficiencies <u>do not require emergency or urgent actions.</u> <u>The MOT may have limitations placed on its operational status.</u>
P4	Specified whenever damage or defects requiring repair are observed. <u>The berthing system is fit-for-purpose. Repair can be performed during normal maintenance cycles, but not to exceed one year.</u>
R	Recommended action is a good engineering/maintenance practice, but not required by these standards. <u>The berthing system is fit-for-purpose.</u>

**TABLE 31F-2-6  
FOLLOW-UP ACTIONS [2.2]**

FOLLOW-UP ACTION	DESCRIPTION
Emergency Action	Specified whenever a condition which poses an immediate threat to public health, safety or the environment is observed. Emergency Actions may consist of barricading or closing all or portions of the berthing system, limiting vessel size, placing load restrictions, evacuating product lines, ceasing transfer operations, etc.
Engineering Evaluation	Specified whenever damage or deficiencies are observed which require further investigation or evaluation to determine appropriate follow-up actions.
Repair Design Inspection	Specified whenever damage or defects requiring repair are observed. The repair design inspection is performed to the level of detail necessary to prepare appropriate repair plans, specifications and estimates.
Upgrade Design and Implementation	Specified whenever the system requires upgrading in order to comply with the requirements of these standards and current applicable codes.
Special Inspection	Typically specified to determine the cause or significance of nontypical deterioration, usually prior to designing repairs. Special testing, laboratory analysis, monitoring or investigation using nonstructural equipment or techniques are typically required.
Develop and Implement Repair Plans	Specified when the Repair Design Inspection and required Special Inspections have been completed. Indicates that the structure is ready to have repair plans prepared and implemented.
No Action	Specified when no further action is necessary until the next scheduled audit or inspection.

and methodology of any supplemental inspections (e.g., special inspections (see Section 3102F.3.5.3).

The following information may be important in determining the need for, and methodology of, the post-event inspection:

1. Earthquakes or vessel or debris impact typically cause damage both above and below the water line. Following a major earthquake, the inspection should focus on components likely to attract highest lateral loads (batter or shorter piles in the rear of the structure, etc.). In case of vessel or debris impact, the inspection effort should focus on components in the path of the impact mass.
2. Major floods or tsunamis may cause undermining of the structure, and/or scouring at the mud line.
3. Fire damage varies significantly with the type of construction materials but all types may be adversely affected. Special inspections (sampling and laboratory testing) shall be conducted, as determined by the inspection team leader, in order to determine the nature and extent of damage.
4. High wind or wave events often cause damage both above and below the water line. An underwater inspection may be required if damage is visible above the waterline. Structural damage may be potentially increased if a vessel was at the berth during the event. The effects of high wind may be most prevalent on equipment and connections of such equipment to the structure.

The methodology of conducting an underwater post-event inspection should be established with due consideration of the structure type and type of damage anticipated. Whereas slope failures or scour may be readily apparent in waters of adequate visibility, overstressing cracks on piles covered with marine growth will not be readily apparent. Where such hidden damage is suspected, marine growth removal should be performed on a representative sampling of components in accordance with the Level II effort requirements described in Section 3102F.3.5.2. The cause of the event will determine the appropriate sample size and locations.

**3102F.4.4 Post-event ratings.** A post-event rating [2.2] shall be assigned to each berthing system upon completion of the inspection (see Table 31F-2-9). All observations of the above and under water structure, mechanical and electrical components and systems shall be considered in assigning a post-event rating.

Ratings should consider only damage that was likely caused by the event. Pre-existing deterioration such as corrosion damage should not be considered unless the structural integrity is immediately threatened or safety systems or protection of the environment may be compromised.

Assignment of ratings should reflect an overall characterization of the berthing system being rated. The rating shall consider both the severity of the deterioration and the extent to which it is widespread throughout the facility. The fact that the facility was designed for loads that are lower than the current standards for design should have no influence upon the ratings.

**3102F.4.5 Follow-up actions.** Follow-up actions shall be assigned upon completion of the post-event inspection of

each berthing system. Table 31F-2-5 specifies remedial action priorities for deficiencies. Table 31F-2-6 specifies various follow-up actions. Multiple follow-up actions may be assigned; however, guidance should be provided as to the order in which the follow-up actions should be carried out. Follow-up actions shall be subject to Division approval.

**3102F.4.6 Documentation and reporting.** Documentation of the specific attributes of each defect shall not be required during a post-event inspection. However, a narrative description of significant damage shall be used. The description shall be consistent with and shall justify the post-event rating assigned.

A report shall be prepared and submitted to the Division upon completion of the post-event inspection and shall, at a minimum, include:

1. Brief description of the facility including the physical limits of the structure, type of construction material(s), and the mechanical and electrical systems present
2. Brief description of the event triggering the inspection
3. Scope of the inspection (above water, underwater, electrical or mechanical)
4. Date of the inspection
5. Names and affiliations of inspection team
6. Description of the nature, extent and significance of any observed damage resulting from the event
7. Photographs should be provided to substantiate the descriptions and justify the condition rating
8. Assignment of a post-event rating
9. Statement regarding whether the facility is fit to resume operations and, if so, under what conditions
10. Assignment of follow-up action(s)
11. Inspection data, drawings, calculations and other relevant engineering materials
12. Signature and stamp of team leader(s)

**3102F.4.7 Action Plan Report.** Upon completion of all actions delineated in the action plan, a final report shall be submitted to the Division to document the work completed. Supporting documentation such as calculations or other relevant data shall be provided in appendices.

### 3102F.5 References.

- [2.1] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5, Marine Terminals Inspection and Monitoring, Sections 2315, 2320, 2325 and 2385 (short form example: 2 CCR 2315 (Title 2 of California Code of Regulations, Section 2315).
- [2.2] Childs, K.M., editor, 2001, "Underwater Investigations - Standard Practice Manual," American Society of Civil Engineers, Reston, VA.

Authority: Sections 8755 and 8757, Public Resources Code

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

TABLE 31F-2-7A

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1A)									REV. # MM/YYYY
	GLOBAL OPERATIONAL STRUCTURAL ASSESSMENT RATINGS (OSAR)									
Berthing system	Berth(s) <sup>1</sup>	Structure(s) <sup>1</sup>	Type of analysis <sup>2</sup>	OSAR rating <sup>4</sup>	Last audit date (MM/YYYY)	Next audit due date (MM/YYYY)	Last analysis date (MM/YYYY) <sup>5</sup>	Repair/replacement due date (MM/YYYY) <sup>6</sup>	Fit-for-purpose (Y/N)	Description or comments <sup>7</sup>
North Wharf	Berth 1	Wharfhead	O	5	08/2008	08/2011	02/2008	N/A	Y	None
North Wharf	Berth 1	Mooring Dolphin	M	2	08/2008	08/2011	05/2008	12/2008	N	Hook capacity inadequate
North Wharf	Berth 1	Breasting Dolphin	B	3	08/2008	08/2011	06/2008	02/2010	Y	Berthing velocity restrictions required. Velocity monitoring system operational. Fender system to be upgraded. See Terminal Operating Limits.
North Wharf	Berth 1	Overall	O	4	08/2008	08/2011	02/2008	N/A	Y	None
North Wharf	Berth 1	Dolphins, Trestles, Catwalks, Bulkhead walls, etc.			08/2008	08/2011				
South Wharf	Berth 2				08/2008	08/2011				

TABLE 31F-2-7B

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1B) GLOBAL SEISMIC STRUCTURAL ASSESSMENT RATINGS (SSAR)								REV. # MM/YYYY
	Berth(s) <sup>1</sup>	Structure(s) <sup>1</sup>	SSAR rating <sup>4</sup>	Last audit date (MM/YYYY)	Next audit due date (MM/YYYY)	Last analysis date (MM/YYYY) <sup>5</sup>	Repair/replacement due date (MM/YYYY) <sup>6</sup>	Fit-for-purpose (Y/N)	
Berthing system									Description or comments <sup>7</sup>  Level 1 – OK; SAP2000 Pushover Analysis Level 2 – NG; SAP2000 Pushover Analysis displacements too large and liquefaction
North Wharf	Berth 1	Wharfhead	2	08/2008	08/2011	05/2008	02/2010	N	
North Wharf	Berth 1	Trestle	5	08/2008	08/2011	05/2008	N/A	Y	
North Wharf	Berth 1	30" Crude line	5	08/2008	08/2011	05/2008	N/A	Y	Level 1 – N/A Level 2 – OK; CAESAR Analysis
North Wharf	Overall	Overall							
North Wharf	Berth 1	Dolphins, Pipeline Trestle, Bulkhead walls, etc.							
South Wharf	Berth 2								

TABLE 31F-2-7C

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1C)							REV. # MM/YYYY
	GLOBAL INSPECTION CONDITION ASSESSMENT RATINGS (ICAR) <sup>8</sup>							
Berthing system	Berth(s) <sup>1</sup>	Structure(s) <sup>1</sup>	Type of inspection <sup>3</sup>	ICAR rating <sup>4, 9</sup>	Last inspection date (MM/YYYY) <sup>10</sup>	Inspection interval (YRS.)	Next inspection due date (MM/YYYY) <sup>10</sup>	Description or comments <sup>7</sup>
North Wharf	Berth 1	Wharfhead	AW	5	02/2008	3	02/2011	General satisfactory condition. See RAPs in Table ES-2 for details.
North Wharf	Berth 1	Wharfhead	UW	4	02/2008	5	02/2013	Pile damage; 10 serve, 15 minor See RAPs in Table ES-2 for details.
North Wharf	Berth 1	Breasting Dolphin BD-1	AW	6	02/2008	3	02/2011	See RAPs in Table ES-2
North Wharf	Overall	Breasting Dolphin BD-1	UW	5	02/2008	5	02/2013	See RAPs in Table ES-2
North Wharf	Berth 1	Dolphins, Trestle, Carwalks, Bulkhead walls, etc.						
South Wharf	Berth 2							

These notes apply to Tables 31F-2-7A through 7C:

1. The term "Overall" shall be input in this field when the assessment ratings are summarized for a berth.
2. "Types of Analyses": "O" = Operational Loading Analysis, "M" = Mooring Analysis, "B" = Berthing Analysis
3. "Types of Inspections": "AW" = Above Water Inspection, "UW" = Underwater Inspection
4. All assessment ratings shall be assigned in accordance with Table 31F-2-4.
5. The "Analysis Dates" are defined by the month and year in which the final design package is submitted to the Division.
6. The "Repair/Replacement Dates" are defined by the month and year in which the repair/replacement is to be completed and operational.
7. The "Description or Comments" shall reference all MOT operating limits. For OSARs, this includes berthing velocity restrictions, load limits, etc. For SSARs, this includes a brief list of the findings for each Seismic Performance Level.
8. Inspection findings may trigger a structural reassessment (see Tables 31F-2-7A and 31F-2-7B).
9. Ratings shall be assigned comparing the observed condition to the original condition.
10. The "Inspection Dates" are defined by the month and year in which the last day of formal field inspection is conducted.



TABLE 31F-2-8

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-2) COMPONENT DEFICIENCY REMEDIAL ACTION PRIORITIES (RAP) <sup>1</sup>											REV. # MM/YYYY
	Berth(s)	Structure(s) or locations(s)	Deficiency item label <sup>2</sup>	Component: deficiency description	Remedial action priority (RAP) <sup>3</sup>	CBC section reference	Audit checklist reference (optional)	Description of planned remedial action	P.E. review required? (Y/N) <sup>4</sup>	Repair/ replacement due date (MM/YYYY)	Completion date (MM/YYYY)	
Berthing system												
North Wharf	Berth 1	Wharfhead	02.0001.001	<b>Piles:</b> 10 piles have severe damage; 15 piles have minor damage.	P2	3102F.3.5.2		Replace 10 severe piles. Monitor 15 minor piles.	Y	05/2008	04/2008	10 piles replaced
North Wharf	Berth 1	Mooring Dolphin MD-1	02.0001.002	<b>Curb:</b> Spalling of concrete curb w/o exposed reinforcement.	R	3102F.3.5.2		Repair concrete curbs.	N	02/2009		
North Wharf	Berth 1	Wharfhead	08.0001.002	<b>International Shore Fire Connection:</b> Connections available, but not connected.	P3	3108F.6.3.4	8.6.22	Install International Shore Fire Connections.	N	10/2008		
North Wharf	Berth 1	Wharfhead	11.0001.001	<b>Conduit Seals near Manifold:</b> Conduit seals inadequate for Class 1, Division 1 location.	P1	3111F.2		Replace conduit seals with seals adequate for Class 1, Division 1 location within 30 days.	Y	04/2008	04/2008	Seals replaced
North Wharf	Berth 1	Wharfhead	11.0002.001	<b>Pressurized Instrumentation Panel near Shelter:</b> Pressure gauge reads "low", and will not hold pressure in Class 1, Division 2 location.	P2	3111F.2	3111F.4.5	Repair pressurized instrumentation panel in Class 1, Division 2 location within 60 days.	Y	05/2008	05/2008	Pressurized instrumentation panel could not be repaired and was replaced.

These notes apply to Table 31F-2-8:

1. After a deficiency is corrected/completed, the row of text corresponding to that deficiency may be grayed out in subsequent ES-2 tables, and removed entirely in the subsequent audit.
2. The "Deficiency Item Labels" shall be assigned in the format shown above with the first series of numbers representing the Code Division/Section number ("XX"), a period ("."), a period ("..") for separation, the second series of numbers representing the deficiency item number ("XXXX"), a period ("..") for separation, and the third series of numbers representing the ES-2 table revision number ("XXX") in which the deficiency was first reported. Note that the deficiency item numbering will start from "0001" for the first deficiency in each section of the audit, and will increase consecutively in all future ES-2 tables.
3. RAPs shall be assigned in accordance with Table 31F-2-5.
4. Professional engineering review required in accordance with Section 3102F.3.8 under "Follow-up Actions."



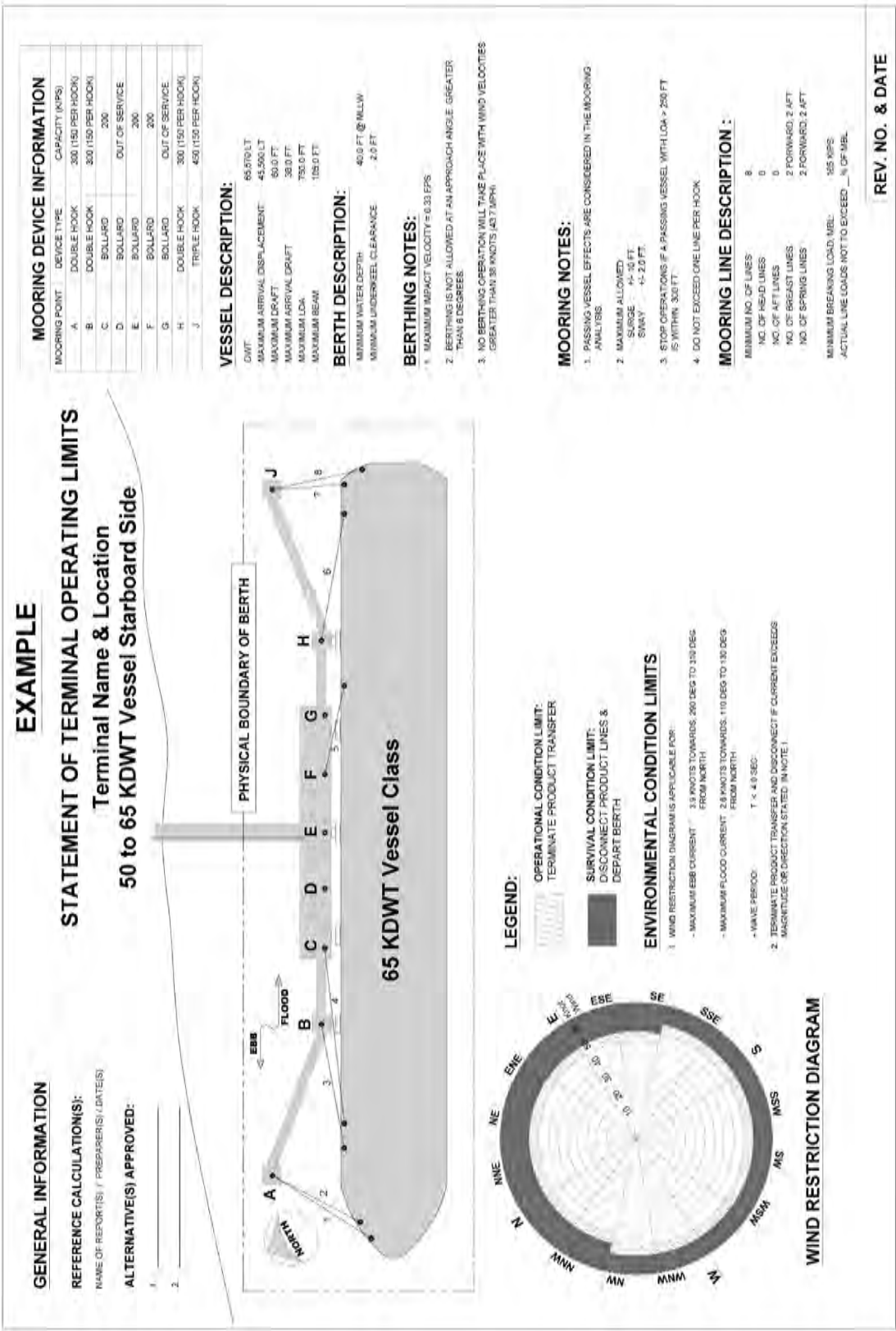


FIGURE 31F-2-1

**TABLE 31F-2-9  
POST-EVENT RATINGS AND REMEDIAL ACTIONS [2.2]**

<b>RATING</b>	<b>SUMMARY OF DAMAGE</b>	<b>REMEDIAL ACTIONS</b>
<i>A</i>	<i>No significant event-induced damage observed.</i>	<i>No further action required. The berthing system may continue operations.</i>
<i>B</i>	<i>Minor to moderate event-induced damage observed but all primary structural elements and electrical/mechanical systems are sound.</i>	<i>Repairs or mitigation may be required to remain operational. The berthing system may continue operations.</i>
<i>C</i>	<i>Moderate to major event-induced damage observed which may have significantly affected the load bearing capacity of primary structural elements or the functionality of key electrical/mechanical systems.</i>	<i>Repairs or mitigation may be necessary to resume or remain operational. The berthing system may be allowed to resume limited operations.</i>
<i>D</i>	<i>Major event-induced damage has resulted in localized or widespread failure of primary structural components; or the functionality of key electrical/mechanical systems has been significantly affected. Additional failures are possible or likely to occur.</i>	<i>The berthing system may not resume operations until the deficiencies are corrected.</i>

## Division 3

### SECTION 3103F STRUCTURAL LOADING CRITERIA

**3103F.1 General.** Section 3103F establishes the environmental and operating loads acting on the marine oil terminal (MOT) structures and on moored vessel(s). The analysis procedures are presented in Sections 3104F – 3107F.

#### 3103F.2 Dead loads.

**3103F.2.1 General.** Dead loads shall include the weight of the entire structure, including permanent attachments such as loading arms, pipelines, deck crane, fire monitor tower, gangway structure, vapor control equipment and mooring hardware. Unit weights specified in Section 3103F.2.2 may be used for MOT structures if actual weights are not available.

**3103F.2.2 Unit weights.** The unit weights in Table 31F-3-1 may be used for both existing and new MOTs.

**TABLE 31F-3-1  
UNIT WEIGHTS**

MATERIAL	UNIT WEIGHT (pcf)*
Steel or cast steel	490
Cast iron	450
Aluminum alloys	175
Timber (untreated)	40-50
Timber (treated)	45-60
Concrete, reinforced (normal weight)	145-160
Concrete, reinforced (lightweight)	90-120
Asphalt paving	150

\* pounds per cubic foot

**3103F.2.3 Equipment and piping area loads.** The equipment and piping area loads in Table 31F-3-2 may be used, as a minimum, in lieu of detailed as-built data.

**TABLE 31F-3-2  
EQUIPMENT AND PIPING AREA LOADS**

LOCATION	AREA LOADS (psf)**
Open areas	20*
Areas containing equipment and piping	35**
Trestle roadway	20*

\* Allowance for incidental items such as railings, lighting, miscellaneous equipment, etc.

\*\* 35 psf is for miscellaneous general items such as walkways, pipe supports, lighting and instrumentation. Major equipment weight shall be established and added into this weight for piping manifold, valves, deck crane, fire monitor tower, gangway structure and similar ma/or equipment.

\*\*\* pounds per square foot

**3103F.3 Live loads and buoyancy.** The following vertical live loading shall be considered, where appropriate: uniform loading, truck loading, crane loading and buoyancy. Additionally, MOT specific, nonpermanent equipment shall be identified and used in loading computations.

#### 3103F.4 Earthquake loads.

**3103F.4.1 General.** Earthquake loads are described in terms of Peak Ground Acceleration (PGA), spectral acceleration and earthquake magnitude. The required seismic analysis procedures (Tables 31F-4-2 and 31F-4-3) are dependent on the risk classification obtained from Table 31F-4-1.

**3103F.4.2 Design earthquake motion parameters.** The earthquake ground motion parameters of peak ground acceleration, spectral acceleration and earthquake magnitude are modified for site amplification and near fault directivity effects. The resulting values are the design peak ground acceleration (DPGA), design spectral acceleration (DSA) and design earthquake magnitude (DEM).

The peak ground and spectral acceleration may be evaluated using:

1. U.S. Geological Survey (USGS) or California Geological Survey [CGS, formerly the California Division of Mines and Geology (CDMG)] maps as discussed in Section 3103F.4.2.2,
2. A site-specific probabilistic seismic hazard analysis (PSHA) as discussed in Section 3103F.4.2.3.
3. For the Ports of Los Angeles, Long Beach and Port Hueneme, PSHA results are provided in Section 3103F.4.2.3.

Unless stated otherwise, the DSA values are for 5 percent damping; values at other levels may be obtained as per Section 3103F.4.2.9.

The appropriate probability levels associated with DPGA and DSA for different seismic performance levels are provided in Table 31F-4 -2. Deterministic earthquake motions, which are used only for comparison to the probabilistic results, are addressed in Section 3103F.4.2. 7.

The evaluation of Design Earthquake Magnitude (DEM), is discussed in Section 3103F.4.2.8. This parameter is required when acceleration time histories (Section 3103F.4.2.10) are addressed or if liquefaction potential (Section 3106F.3) is being evaluated.

**3103F.4.2.1 Site classes.** The following site classes, defined in Section 3106F.2, shall be used in developing values of DSA and DPGA:

$S_A$ ,  $S_B$ ,  $S_C$ ,  $S_D$ ,  $S_E$  and  $S_F$ .

For  $S_F$ , a site-specific response analysis is required per Section 3103F.4.2.5.

**3103F.4.2.2 Earthquake motions from USGS maps.** Earthquake ground motion parameters can be obtained from the Maps 29-32 in the National Earthquake Hazard Reduction Program (NEHRP) design map set discussed in subsection 1.6.1 of [3.1], or the USGS website: (<http://earthquake.usgs.gov/research/hazmaps/>). These are available as peak ground acceleration and spectral acceleration values at 5 percent damping for 10 and 2 percent probability of exceedance in 50 years, which correspond to Average Return Periods (ARPs) of 475 and 2,475 years, respectively. The spectral acceleration values are available for 0.2, and 1.0 second spectral periods. In obtaining peak ground acceleration and spectral acceleration values from the USGS web site, the site location can be specified in terms of site longitude and latitude or the zip code when appropriate. The

resulting values of peak ground acceleration and spectral acceleration correspond to surface motions for Site Classification approximately corresponding to the boundary of Site Class  $S_B$  and  $S_C$ .

Once peak ground acceleration and spectral acceleration values are obtained for 10 and 2 percent probability of exceedence in 50 years, the corresponding values for other probability levels may be obtained. A procedure is presented in subsection 1.6 of Chapter 1 of [3.1].

**3103F.4.2.3 Earthquake motions from site-specific probabilistic seismic hazard analyses.** Peak ground acceleration and spectral acceleration values can be obtained using site-specific probabilistic seismic hazard analysis (PSHA). In this approach, the seismic sources and their characterization used in the analysis shall be based on the published data from the California Geological Survey, which can be obtained online at the following website: (<http://www.conservation.ca.gov/CGS/Pages/Index.aspx>) [3.2].

Appropriate attenuation relationships shall be used to obtain values of peak ground acceleration and spectral acceleration at the ground surface for site conditions corresponding to the boundary of Site Class  $S_B$  and  $S_C$ , regardless of the actual subsurface conditions at the site. These results shall be compared to those based on the FEMA/USGS maps discussed in Section 3103F.4.2.2. If the two sets of values are significantly different, a justification for using the characterization chosen shall be provided.

Alternatively, peak ground acceleration and spectral accelerations at the ground surface for the subsurface conditions that actually exist at the site may be directly

obtained by using appropriate attenuation relationships in a site-specific PSHA. This approach is not permissible for Site Classes  $S_E$  and  $S_F$ .

For site-specific PSHA, peak ground acceleration and spectral acceleration values corresponding to the seismic performance level (See Table 31F-4-2) shall be obtained.

For peak ground acceleration, PSHA may be conducted using the “magnitude weighting” procedure in Idriss [3.3]. The actual magnitude weighting values should follow the Southern California Earthquake Center (SCEC) procedures [3.4]. This magnitude weighting procedure incorporates the effects of duration corresponding to various magnitude events in the PSHA results. The resulting peak ground acceleration shall be used only for liquefaction assessment (see Section 3106F.4).

PSHA have been developed for the Ports of Los Angeles and Long Beach [3.5, 3.6] and provide site-specific information for seismic analyses. Table 31F-3-3 provides response spectra, for a 475 year return period earthquake and 5 percent critical damping. Figure 31F-3-1 provides the corresponding spectra for the two ports. Additionally, these references provide spectra for return periods from 72 to 2,500 years.

For the port of Port Hueneme, a PSHA was performed by Lawrence Livermore National Laboratory [3.7] and the results are shown in Table 31F-3-4 and Figure 31F-3-2. These results are provided only for site classification “ $S_C$ ” and five percent critical damping. To obtain appropriate values for piles and/or the mudline, the simplified procedures of Section 3103F.4.2.4 may be used.

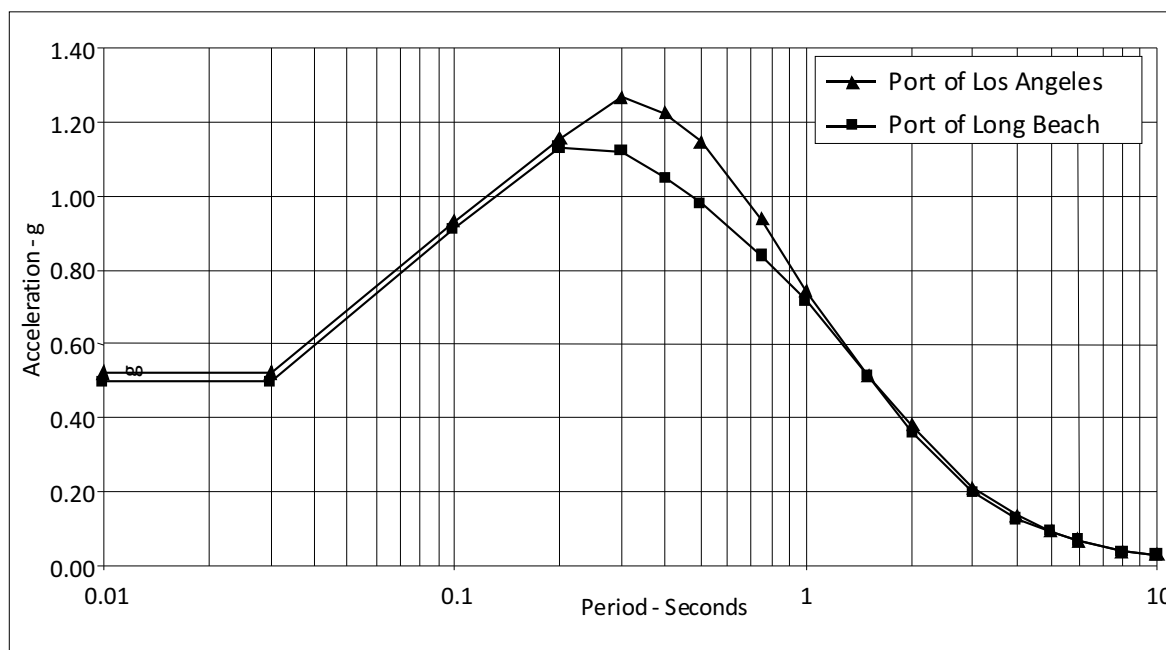


FIGURE 31F-3-1 DESIGN ACCELERATION RESPONSE SPECTRA FOR THE PORTS OF LOS ANGELES AND LONG BEACH, 475 YEAR RETURN PERIOD (5% Critical Damping)

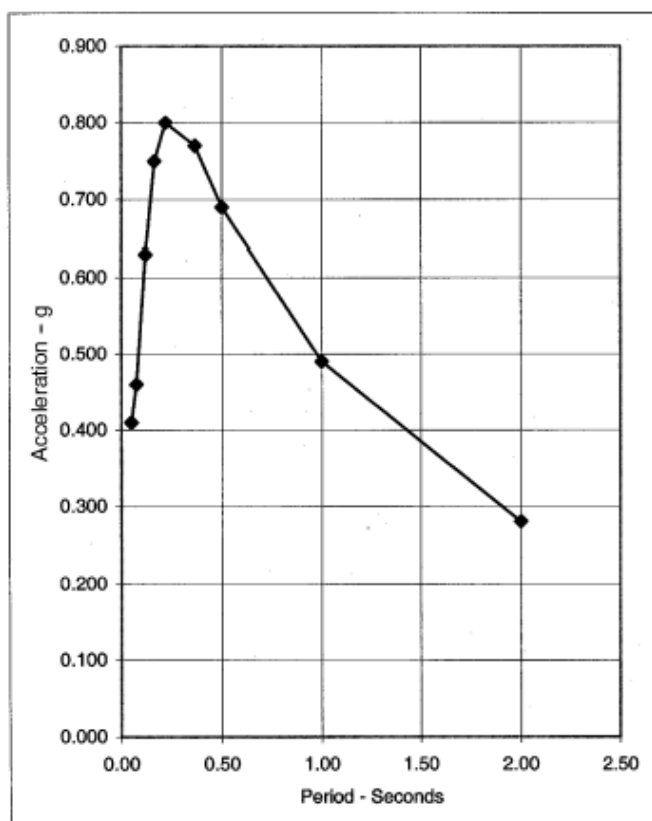


FIGURE 31F-3-2 RESPONSE SPECTRA FOR PORT HUENEME, 475 YEAR RETURN PERIOD (5% Critical Damping)

**3103F.4.2.4 Simplified evaluation of site amplification effects.** When the MOT Site Class is different from the  $S_B$ - $S_C$  boundary, site amplification effects shall be incorporated in peak ground accelerations and spectral accelerations. This may be accomplished using a simplified method or a site-specific evaluation (Section 3103F.4.2.5).

For a given site class, the following procedure [3.1] presents a simplified method that may be used to incorporate the site amplification effects for peak ground acceleration and spectral acceleration computed for the  $S_B$  and  $S_C$  boundary.

1. Calculate the spectral acceleration values at 0.20 and 1.0 second period:

$$S_{XS} = F_a S_S \quad (3-1)$$

$$S_{XI} = F_v S_I \quad (3-2)$$

where:

$F_a$  = site coefficient obtained from Table 31F-3-5

$F_v$  = site coefficient obtained from Table 31F-3-6

$S_S$  = short period (usually at 0.20 seconds) spectral acceleration value (for the boundary of  $S_B$  and  $S_C$ ) obtained using Section 3103F.4.2.2, or at

the period corresponding to the peak in spectral acceleration values when obtained from Section 3103F.4.2.3

$S_I$  = spectral acceleration value (for the boundary of  $S_B$  and  $S_C$ ) at 1.0 second period

$S_{XS}$  = spectral acceleration value obtained using the short period  $S_S$  and factored by Table 31F-3-5 for the Site Class under consideration.

$S_{XI}$  = spectral acceleration value obtained using the 1.0 second period  $S_I$  and factored by Table 31F-3-6 for the Site Class under consideration.

$$2. \text{ Set } PGA_X = 0.4S_{XS} \quad (3-3)$$

where:

$PGA_X$  = peak ground acceleration corresponding to the Site Class under consideration.

When the value of  $PGA_X$  is less than the peak ground acceleration obtained following Section 3103F.4.2.2 or Section 3103F.4.2.3, an explanation of the results shall be provided.

3.  $PGA_X$ ,  $S_{XS}$ , and  $S_{XI}$  constitute three spectral acceleration values for the Site Class under consideration corresponding to periods of 0,  $S_S$  (usually 0.2 seconds), and 1.0 second, respectively.

4. The final response spectra, without consideration for near-fault directivity effects, values of  $S_a$  for the Site Class under consideration may be obtained using the following equations (for 5 percent critical damping):

$$\text{for } 0 < T < 0.2T_0$$

$$S_a = (S_{XS})(0.4 + 3T/T_0) \quad (3-4)$$

where:

$T$  = Period corresponding to calculated  $S_a$

$T_0$  = Period at which the constant acceleration and constant velocity regions of the design spectrum intersect

$$\text{for } 0.2T_0 < T < T_0$$

$$S_a = S_{XS} \quad (3-5)$$

$$\text{for } T > T_0$$

$$S_a = S_{XI}/T \quad (3-6)$$

where:

$$T_0 = S_{XI}/S_{XS} \quad (3-7)$$

The resulting  $PGA_X$  is the DPGA. However, the  $S_a$  (except for the ports of Los Angeles, Long Beach and Port Hueneme) shall be modified for near-fault directivity effects, per Section 3103F.4.2. 6 to obtain the final DSAs.



**TABLE 31F-3-3  
DESIGN ACCELERATION RESPONSE SPECTRA FOR THE  
PORTS OF LOS ANGELES AND LONG BEACH, 475 YEAR  
RETURN PERIOD (5% Critical Damping)**

Period (sec)	Spectral Acceleration (g's)	
	Port of Los Angeles	Port of Long Beach
0.01	0.520	0.500
0.03	0.520	0.500
0.1	0.931	0.910
0.2	1.154	1.132
0.3	1.270	1.121
0.4	1.223	1.050
0.5	1.148	0.980
0.75	0.937	0.840
1.0	0.740	0.717
1.5	0.510	0.510
2.0	0.380	0.362
3.0	0.210	0.199
4.0	0.135	0.128
5.0	0.094	0.091
6.0	0.069	0.068
8.0	0.041	0.041
10.0	0.027	0.027

**TABLE 31F-3-4  
RESPONSE SPECTRA FOR PORT HUENEME,  
475 YEAR RETURN PERIOD (5% Critical Damping)**

SITE CLASS "C" (Shear Wave Velocity from 1200-2500 ft/sec)		
Period (sec)	Frequency (Hz)	Spectral Acceleration (g's)
0.03	33.33	0.41
0.05	20.00	0.46
0.10	10.0	0.63
0.15	6.67	0.75
0.20	5.0	0.80
0.30	3.33	0.78
0.50	2.00	0.69
1.0	1.0	0.49
2.0	0.50	0.28

**TABLE 31F-3-5  
VALUES OF  $F_a$**

SITE CLASS	$S_s$				
	< 0.25	0.5	0.75	1.0	> 1.25
$S_A$	0.8	0.8	0.8	0.8	0.8
$S_B$	1.0	1.0	1.0	1.0	1.0
$S_C$	1.2	1.2	1.1	1.0	1.0
$S_D$	1.6	1.4	1.2	1.1	1.0
$S_E$	2.5	1.7	1.2	0.9	0.9
$S_F$	*	*	*	*	*

**Note:** Linear interpolation can be used to estimate values of  $F_a$  for intermediate values of  $S_s$ .

\* Site-specific dynamic site response analysis shall be performed.

**TABLE 31F-3-6  
VALUES OF  $F_v$**

SITE CLASS	$S_1$				
	< 0.1	0.2	0.3	0.4	> 0.5
$S_A$	0.8	0.8	0.8	0.8	0.8
$S_B$	1.0	1.0	1.0	1.0	1.0
$S_C$	1.7	1.6	1.5	1.4	1.3
$S_D$	2.4	2.0	1.8	1.6	1.5
$S_E$	3.5	3.2	2.8	2.4	2.4
$S_F$	*	*	*	*	*

**Note:** Linear interpolation can be used to estimate values of  $F_v$  for intermediate values of  $S_1$ .

\* Site-specific dynamic site response analysis shall be performed.

**3103F.4.2.5 Site-specific evaluation of amplification effects.** As an alternative to the procedure presented in Section 3103F.4.2.4, a site-specific response analysis may be performed. For  $S_E$ , a site specific response analysis is required. The analysis shall be either an equivalent linear or nonlinear analysis. Appropriate acceleration time histories as discussed in Section 3103F.4.2.10 shall be used.

In general, an equivalent linear analysis using, for example, SHAKE91 [3.8] is acceptable when the strength and stiffness of soils are unlikely to change significantly during the seismic shaking, and the level of shaking is not large. A nonlinear analysis should be used when the strength and/or stiffness of soils could significantly change during the seismic shaking or significant nonlinearity of soils is expected because of high seismic shaking levels.

The choice of the method used in site response analysis shall be justified considering the expected stress-strain behavior of soils under the shaking level considered in the analysis.

Site-specific site response analysis may be performed using one-dimensional analysis. However, to the extent that MOTs often involve slopes or earth retaining structures, the one-dimensional analysis should be used judiciously. When one-dimensional analysis cannot be justified or is not adequate, two-dimensional equivalent linear or nonlinear response analysis shall be performed. Site-specific response analysis results shall be compared to those based on the simplified method of Section 3103F.4.2.4 for reasonableness.

For the port areas of Los Angeles, Long Beach and Port Hueneme, the resulting response spectra shall not fall below values obtained in Section 3103F.4.2.3.

The peak ground accelerations obtained from this site-specific evaluation are DPGAs and the spectral accelerations are DSAs as long as the near-fault directivity effects addressed in Section 3103F.4.2.6 are appropriately incorporated into the time histories (Section 3103F.4.2.10).

**3103F.4.2.6 Directivity effects.** When the site is 15 km (9.3 miles) or closer to a seismic source that can significantly affect the site, near-fault directivity effects shall be reflected in the spectral acceleration values and in the

deterministic spectral acceleration values of Section 3103F.4.2. 7. However, Tables 31F-3-3 and 31F-3-4 for the port areas of Los Angeles, Long Beach and Port Hueneme already have these effects included.

Two methods are available for incorporating directivity effects.

1. Directivity effects may be reflected in the spectral acceleration values in a deterministic manner by using, for example, the equation on pg. 213 (and Tables 6 and 7) of Somerville, et al. [3.9]. The critical seismic sources and their characterization developed as part of the deterministic ground motion parameters (Section 3103F.4.2. 7) should be used to evaluate the directivity effects. The resulting adjustments in spectral acceleration values may be applied in the probabilistic spectral acceleration values developed per Section 3103F.4.2.4 or 3103F.4.2.5. Such adjustment can be independent of the probability levels of spectral accelerations.
2. Directivity effects may be incorporated in the results of site specific PSHA per Section 3103F.4.2.3. In this case, the directivity effects will also depend on the probability level of spectral accelerations.

If spectral accelerations are obtained in this manner, the effects of site amplification using either Section 3103F.4.2.4, 3103F.4.2.5 or an equivalent method (if justified) shall be incorporated.

**3103F.4.2.7 Deterministic earthquake motions.** Deterministic ground motions from “scenario” earthquakes may be used for comparison purposes. Deterministic peak ground accelerations and spectral accelerations may be obtained using the “Critical Seismic Source” with maximum earthquake magnitude and its closest appropriate distance to the MOT. “Critical Seismic Source” is that which results in the largest computed median peak ground acceleration and spectral acceleration values when appropriate attenuation relationships are used. The values obtained from multiple attenuation relationships should be used to calculate the median peak ground acceleration and spectral acceleration values.

For comparison, the values of peak ground accelerations and spectral accelerations may be obtained from the USGS maps [3.1], corresponding to the Maximum Considered Earthquake (MCE). In this case, the median values of peak ground acceleration and spectral acceleration values shall be 213 (see Subsection 1.6 of [3.1]) of the values shown on the USGS maps.

**3103F.4.2.8 Design earthquake magnitude.** The design earthquake magnitude used in developing site-specific acceleration time histories (Section 3103F.4.2.10) or liquefaction assessment (Section 3106F.3) is obtained using either of the following two methods.

1. The design earthquake may be selected as the largest earthquake magnitude associated with the critical seismic source. The distance shall be taken as the closest distance from the source to the site. The resulting design earthquake shall be associated

with all DPGA values for the site, irrespective of probability levels.

2. The design earthquake (DEQ) may be obtained for each DPGA or DSA value and associated probability level by determining the corresponding dominant distance and magnitude. These are the values of the distance and magnitude that contribute the most to the mean seismic hazards estimates for the probability of interest. They are usually determined by locating the summits of the 3-D surface of contribution of each small interval of magnitude and distance to the total mean hazards estimate. If this 3-D surface shows several modes with approximate weight of more than 20 percent of the total, several DEQs may be considered, and the DEQ leading to the most conservative design parameters shall be used.

**3103F.4.2.9 Design spectral acceleration for various damping values.** Design spectral acceleration (DSA) values at damping other than 5 percent shall be obtained by using a procedure given in [3.1], and is denoted as  $DSA_d$ . The following procedure does not include near-fault directivity effects.

For  $0 < T < 0.2 T_0$

$$DSA_d = S_{XS} [(5/B_S - 2) T/T_0 + 0.4] \quad (3-8)$$

For  $0.2 T_0 < T < T_0$

$$DSA_d = DSA/B_S \quad (3-9)$$

For  $T > T_0$

$$DSA_d = S_1/(B_1 T) \quad (3-10)$$

**where:**

$T$  = period

$T_0 = S_{X1}/S_{XS}$

$B_S$  = Coefficient used to adjust the short period spectral response, for the effect of viscous damping.

$B_1$  = Coefficient used to adjust one-second period spectral response, for the effect of viscous damping

Values of  $B_S$  and  $B_1$  are obtained from Table 31F-3-7.

Such a procedure shall incorporate the near-fault directivity effects when the MOT is 15 km (9.3 miles) or closer to a significant seismic source.

**TABLE 31F-3-7 [3.1]  
VALUES OF  $B_S$  AND  $B_1$**

DAMPING (%)	$B_S$	$B_1$
< 2	0.8	0.8
5	1.0	1.0
10	1.3	1.2
20	1.8	1.5
30	2.3	1.7
40	2.7	1.9
> 50	3.0	2.0

**Note:** Linear interpolation should be used for damping values not specifically listed.

**3103F.4.2.10 Development of acceleration time histories.** When acceleration time histories are utilized, target spectral acceleration values shall be initially selected corresponding to the DSA values at appropriate probability levels. For each set of target spectral acceleration values corresponding to one probability level, at least three sets of horizontal time histories (one or two horizontal acceleration time histories per set) shall be developed.

Initial time histories shall consider magnitude, distance and the type of fault that are reasonably similar to those associated with the conditions contributing most to the probabilistic DSA values. Preferred initial time histories should have their earthquake magnitude and distance to the seismic source similar to the mode-magnitude and mode-distance derived from the PSHA or from appropriate maps. When an adequate number of recorded time histories are not available, acceleration time histories from simulations may be used as supplements.

Scaling or adjustments, either in the frequency domain or in the time domain (preferably), prior to generating acceleration time histories should be kept to a minimum. When the target spectral accelerations include near-fault directivity effects (Section 3103F.4.2.6), the initial time histories should exhibit directivity effects.

When three sets of time histories are used in the analysis, the envelope of the spectral acceleration values from each time history shall be equal to or higher than the target spectral accelerations. If the envelope values fall below the target values, adjustments shall be made to ensure that the spectral acceleration envelope is higher than target spectral accelerations. If the envelope is not higher, then a justification shall be provided.

When seven or more sets of time histories are used, the average of the spectral acceleration values from the set of time histories shall be equal or higher than the target spectral acceleration values. If the average values fall below the target values, adjustments shall be made to ensure that average values are higher than the target spectral accelerations. If this is not the case, then an explanation for the use of these particular spectral acceleration values shall be provided.

When three sets of time histories are used in the analysis, the maximum value of each response parameter shall be used in the design, evaluation and rehabilitation. When seven or more sets of time histories are used in the analysis, the average value of each response parameter may be used.

### **3103F.5 Mooring loads on vessels.**

**3103F.5.1 General.** Forces acting on a moored vessel may be generated by wind, waves, current, tidal variations, tsunamis, seiches and hydrodynamic effects of passing vessels. Forces from wind and current acting directly on the MOT structure (not through the vessel in the form of mooring and/or breasting loads) shall be determined in Section 3103F.7.

The vessel's moorings shall be strong enough to hold during all expected conditions of surge, current and weather

and long enough to allow adjustment for changes in draft, drift and tide (2 CCR 2340 (c) (1)) [3.10].

**3103F.5.2 Wind loads.** Wind loads on a vessel, moored at a MOT, shall be determined using procedures described in this section. Wind loads shall be calculated for each of the load cases identified in Section 3105F.2.

**3103F.5.2.1 Design wind speed.** The design wind speed is the maximum wind speed of 30-second duration used in the mooring analysis (see Section 3105F).

**3103F.5.2.1.1 Operating condition.** The operating condition is the wind envelope in which a vessel may conduct transfer operations. It is determined from the mooring analysis (Section 3105F). Transfer operations shall cease, at an existing MOT, when the wind exceeds the maximum velocity of the envelope.

**3103F.5.2.1.2 Survival condition.** The survival condition is defined as the state wherein a vessel can remain safely moored at the berth during severe winds. For new MOTs, the survival condition threshold is the maximum wind velocity, for a 30-second gust and a 25-year return period, obtained from historical data.

For an existing MOT, a reduced survival condition threshold is acceptable (see Figure 31F-2-1). If the wind rises above these levels, the vessel must depart the berth; it shall be able to depart within 30 minutes (see 2 CCR 2340 (c) (28)) [3.10].

The 30-second duration wind speed shall be determined from the annual maximum wind data. Average annual summaries cannot be used. Maximum wind speed data for eight directions (45-degree increments) shall be obtained. If other duration wind data is available, it shall be adjusted to a 30-second duration, in accordance with Equation (3.12). The 25-year return period shall be used to establish the design wind speed for each direction. In order to simplify the analysis for barges (or other small vessels), they may be considered to be solid free-standing walls (Chapter 6 of ASCE 7 [3.11]). This will eliminate the need to perform a computer assisted mooring analysis.

**3103F.5.2.2 Wind speed corrections.** Wind speed measured at an elevation of 33 feet (10 meters) above the water surface, with duration of 30 seconds shall be used to determine the design wind speed. If these conditions are not met, the following corrections shall be applied.

The correction for elevation is obtained from the equation:

$$V_w = V_h \left( \frac{33}{h} \right)^{1/7} \quad (3-11)$$

where:

$V_w$  = wind speed at elevation 33 ft. (10 m.)

$V_h$  = wind speed at elevation  $h$

$h$  = elevation above water surface of wind data [feet]



The available wind duration shall be adjusted to a 30-second value, using the following formula:

$$V_{t=30 \text{ sec}} = \frac{V_t}{c_t} \quad (3-12)$$

where:

$V_{t=30 \text{ sec}}$  = wind speed for a 30-second duration

$V_t$  = wind speed over a given duration

$c_t$  = conversion factor from Figure 31F-3-3

If wind data is available over land only, the following equation shall be used to convert the wind speed from over-land to over-water conditions [3.10]:

$$V_w = 1.10 V_L \quad (3-13)$$

where:

$V_w$  = over water wind speed

$V_L$  = over land wind speed

**3103F.5.2.3 Static wind loads on vessels.** The “Mooring Equipment Guidelines (MEG3)” [3.13] or the “British Standard Code of Practice for Maritime Structures” [3.14] shall be used to determine the wind loads for all tank vessels.

Alternatively, wind loads for any type of vessel may be calculated using the guidelines in Ferritto et al, 1999 [3.15].

**3103F.5.3 Current loads.** Environmental loads induced by currents at MOTs shall be calculated as specified in this subsection.

**3103F.5.3.1 Design current velocity.** Maximum ebb and flood currents, annual river runoffs and controlled releases shall be considered when establishing the design current velocities for both existing and new MOTs.

Local current velocities may be obtained from NOAA [3.16] or other sources, but must be supplemented by site-specific data, if the current velocity is higher than 1.5 knots.

Site-specific data shall be obtained by real time measurements over a one-year period. If this information is not available, a safety factor of 1.25 shall be applied to the best available data until real time measurements are obtained.

If the facility is not in operation during annual river runoffs and controlled releases, the current loads may be adjusted.

Operational dates need to be clearly stated in the definition of the terminal operating limits (see Section 3102F.3.6).

**3103F.5.3.2 Current velocity adjustment factors.** An average current velocity ( $V_c$ ) shall be used to compute forces and moments. If the current velocity profile is

known, the average current velocity can be obtained from the following equation:

$$V_c^2 = 1/T \int_0^T (v_c)^2 ds \quad (3-14)$$

where:

$V_c$  = average current velocity (knots)

$T$  = draft of vessel

$v_c$  = current velocity as a function of depth (knots)

$s$  = water depth measured from the surface

If the velocity profile is not known, the velocity at a known water depth should be adjusted by the factors provided in Figure 31F-3-4 to obtain the equivalent average velocity over the draft of the vessel.

**3103F.5.3.3 Static current loads.** The OCIMF [3.13], the British Standard [3.14] or the UFC 4-159-03 [3.17] procedures shall be used to determine current loads for moored tank vessels.

**3103F.5.3.4 Sea level rise (SLR).** All MOTs shall consider the predicted SLR over the remaining life of the terminal, due to subsidence or climate change combined with maximum high tide and storm surge. Consideration shall include but not be limited to variation in fender locations, additional berthing loads (deeper draft vessels) and any components near the splash zone.

**3103F.5.4 Wave loads.** When the significant wave period,  $T_s$ , is greater than 4 seconds (See Section 3105F.3.1), the transverse wave induced vessel reactions shall be calculated using a simplified dynamic mooring analysis described below.

The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The water particle accelerations shall then be used to calculate the wave excitation forces to determine the static displacement of the vessel. The Froude-Krylov method discussed in Chakrabarti's Chapter 7 [3.18] may be used to calculate the wave excitation forces, by conservatively approximating the vessel as a rectangular box with dimensions similar to the actual dimensions of the vessel. The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The computed excitation force assumes a 90-degree incidence angle with the longitudinal axis of the vessel, which will result in forces that are significantly greater than the forces that will actually act upon the vessel from quartering seas. A load reduction factor may be used to account for the design wave incidence angle from the longitudinal axis of the ship. The overall excursion of the vessel shall be determined for each of the wave conditions by calculating the dynamic response of the linear spring mass system.

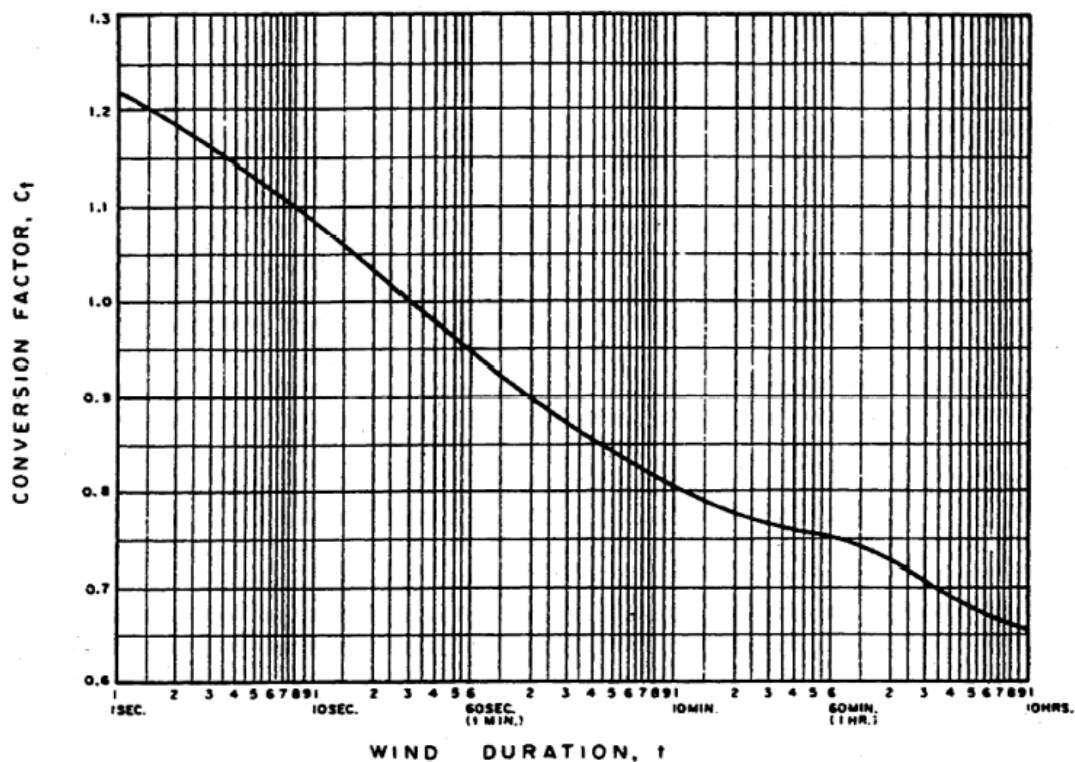


FIGURE 31F-3-3 WIND SPEED CONVERSION FACTOR [3.12]

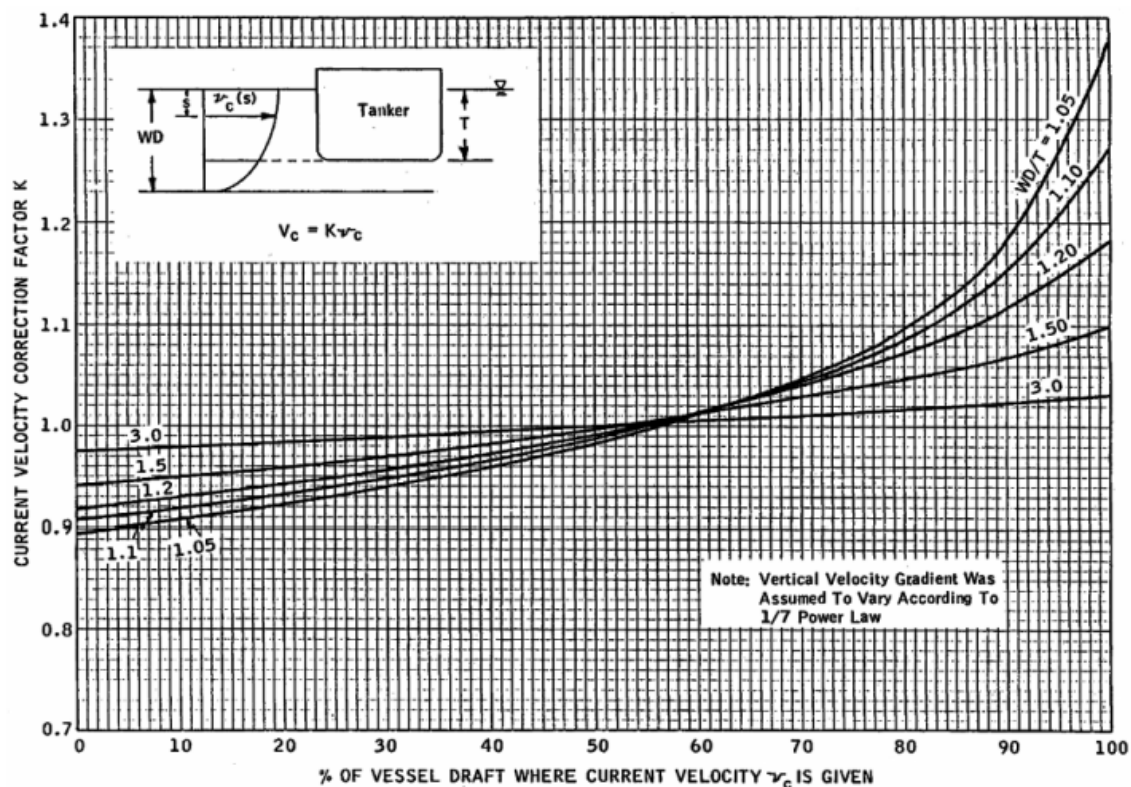


FIGURE 31F-3-4 CURRENT VELOCITY CORRECTION FACTOR (p. 23, OCIMF, 1997 [3.13])

**3103F.5.5 Passing vessels.** When required in Section 3105F.3, the sway and surge forces, as well as yaw moment, on a moored vessel, due to passing vessels, shall be established considering the following:

1. Ratio of length of moored vessel to length of passing vessel.
2. Distance from moored vessel to passing vessel.
3. Ratio of midship section areas of the moored and passing vessels.
4. Underkeel clearances of the moored and passing vessels.
5. Draft and trim of the moored vessel and draft of the passing vessel.
6. Mooring line tensions.

The passing vessel's speed should take into consideration the ebb or flood current. Normal operating wind and current conditions can be assumed when calculating forces due to a passing vessel. Either method of Kriebel [3.19] or Wang [3.20] may be used to determine forces on a moored vessel. Kriebel's recent wave tank study improves on an earlier work of Seelig [3.21].

**3103F.5.6 Seiche.** The penetration of long period low amplitude waves into a harbor can result in resonant standing wave systems, when the wave forcing frequency coincides with a natural frequency of the harbor. The resonant standing waves can result in large surge motions if this frequency is close to the natural frequency of the mooring system. Section 3105F.3.3 prescribes the procedure for the evaluation of these effects.

**3103F.5.7 Tsunamis.** A tsunami may be generated by an earthquake or a subsea or coastal landslide, which may induce large wave heights and excessive currents. The large wave or surge and the excessive currents are potentially damaging, especially if there is a tank vessel moored alongside the MOT wharf.

Tsunamis can be generated either by a distant or near source. A tsunami generated by a distant source (far field event) may allow operators to have an adequate warning for mitigating the risk by depart the MOT and go into deep water. For near-field events, with sources less than 500 miles away, the vessel may not have adequate time to depart. Each MOT shall have a "tsunami plan" describing what actions will be performed, in the event of a distant tsunami.

Recent tsunami studies have been completed for both Southern and Northern California. For the Ports of Los Angeles and Long Beach, one of those recent studies focused on near field tsunamis with predicted return periods of 5,000 to 10,000 years [3.22]. These maximum water levels (run-up) would not normally be used for MOT design. However, because the study also provides actual tidal records from recent distant tsunamis, it should be used for design.

The run-up value for Port Hueneme was obtained from an earlier study by Synolakis et al. [3.23].

Run up-values: Port of Los Angeles and Long Beach = 8 ft.

Port Hueneme = 11 ft.

For the San Francisco Bay, a recent study provides the maximum credible tsunami water levels and current speeds. These results are deterministic and are based on the most severe seismic sources that could reasonably impact MOTs in the San Francisco Bay [3.24]. Table 31F-3-8 provides values for the marine oil terminal locations within San Francisco Bay. Water levels could be positive or negative and current velocities may vary in direction. In order to determine the maximum run-up at a MOT, the largest values should be added to the mean high tide. Further details are available in [3.24].

Loads from tsunami-induced waves can be calculated for various structural configurations [3.25]. Tsunami wave heights in shallow water and particle kinematics can also be obtained. Other structural considerations include uplift and debris impact.

**TABLE 31F-3-8**  
**TSUNAMI RUN-UP VALUES (ft) AND CURRENT SPEEDS (ft/sec)**  
**IN THE SAN FRANCISCO BAY AREA [AFTER 3.24]**

S.F. Bay Locale	Maximum Water Levels (ft.)	Current Velocity (ft/sec)
Richmond, outer	7.5	4.9
Richmond, inner	7.9	8.9
Martinez	2.3	1.3
Selby	2.6	1.6
Rodeo	2.6	2.0
Benicia	2.0	1.0

### 3103F.6 Berthing Loads.

**3103F.6.1 General.** Berthing loads are quantified in terms of transfer of kinetic energy of the vessel into potential energy dissipated by the fender(s). The terms and equations below are based on those in UFC 4-152-01, "Piers and Wharves" [3.26] and PIANC [3.27].

Kinetic energy shall be calculated from the following equation:

$$E_{\text{vessel}} = \frac{1}{2} \cdot \frac{W}{g} \cdot V_n^2 \quad (3-15)$$

where:

$E_{\text{vessel}}$  = Berthing energy of vessel [ft-lbs]

$W$  = Total weight of vessel and cargo in pounds [long tons  $\times$  2240]

$g$  = Acceleration due to gravity [32.2 ft/sec<sup>2</sup>]

$V_n$  = Berthing velocity normal to the berth [ft/sec]



The following correction factors shall be used to modify the actual energy to be absorbed by the fender system for berthing operations:

$$E_{fender} = F_A \cdot C_b \cdot C_m \cdot E_{vessel} \quad (3-16)$$

where:

$E_{fender}$  = Energy to be absorbed by the fender system

$F_A$  = Accidental factor accounting for abnormal conditions such as human error, malfunction, adverse environmental conditions or a combination of these factors. For existing berthing systems,  $F_A$  may be taken as 1.0. For new berthing systems,  $F_A$  shall be determined in accordance with UFC Section 4-152-01 [3.26] or PIANC Section 4.2.8 [3.27].

$C_b$  = Berthing Coefficient

$C_m$  = Effective mass or virtual mass coefficient (see Section 3103F.6.6)

The berthing coefficient,  $C_b$ , is given by:

$$C_b = C_e \cdot C_g \cdot C_d \cdot C_c \quad (3-17)$$

where:

$C_e$  = Eccentricity Coefficient

$C_c$  = Configuration Coefficient

$C_g$  = Geometric Coefficient

$C_d$  = Deformation Coefficient

These coefficients are defined in Sections 3103F.6.2 through 3103F.6.5.

The approximate displacement of the vessel (when only partially loaded) at impact,  $DT$ , can be determined from an extension of an equation from Gaythwaite [3.28]:

$$DT = 1.25 DWT(d_{actual}/d_{max}) \quad (3-18)$$

where:

$DWT$  = Dead Weight Tonnage (in long tons)

$d_{actual}$  = Actual arrival draft of the vessel

$d_{max}$  = Maximum loaded vessel draft

The berthing load shall be based on the fender reaction due to the kinetic berthing energy. The structural capacity shall be established based on allowable concrete, steel or timber properties in the structural components, as defined in Section 3107F.

**3103F.6.2 Eccentricity coefficient ( $C_e$ ).** During the berthing maneuver, when the vessel is not parallel to the berthing line (usually the wharf face), not all the kinetic energy of the vessel will be transmitted to the fenders. Due to the reaction from the fender(s), the vessel will start to rotate around the contact point, thus dissipating part of its energy. Treating the vessel as a rigid rod of negligible width in the analysis of the energy impact on the fenders leads to the equation:

$$C_e = \frac{k^2}{a^2 + k^2} \quad (3-19)$$

where:

$k$  = Longitudinal radius of gyration of the vessel [ft]

$a$  = Distance between the vessel's center of gravity and the point of contact on the vessel's side, projected onto the vessel's longitudinal axis [ft]

**3103F.6.3 Geometric coefficient ( $C_g$ ).** The geometric coefficient,  $C_g$ , depends upon the geometric configuration of the ship at the point of impact. It varies from 0.85 for an increasing convex curvature to 1.25 for concave curvature. Generally, 0.95 is recommended for the impact point at or beyond the quarter points of the ship, and 1.0 for broadside berthing in which contact is made along the straight side [3.26].

**3103F.6.4 Deformation coefficient ( $C_d$ ).** This accounts for the energy reduction effects due to local deformation of the ships hull and deflection of the whole ship along its longitudinal axis. The energy absorbed by the ship depends on the relative stiffness of the ship and the obstruction. The deformation coefficient varies from 0.9 for a nonresilient fender to nearly 1.0 for a flexible fender. For larger ships on energy-absorbing fender systems, little or no deformation of the ship takes place; therefore, a coefficient of 1.0 is recommended.

**3103F.6.5 Configuration coefficient ( $C_c$ ).** This factor accounts for the difference between an open pier or wharf and a solid pier or wharf. In the first case, the movements of the water surrounding the berthing vessel is not (or is hardly) affected by the berth. In the second case, the water between the berthing vessel and the structure introduces a cushion effect that represents an extra force on the vessel away from the berth and reduces the energy to be absorbed by the fender system.

For open berth and corners of solid piers,  $C_c = 1.0$

For solid piers with parallel approach,  $C_c = 0.8$

For berths with different conditions,  $C_c$  may be interpolated between these values [3.26].

**3103F.6.6 Effective mass or virtual mass coefficient ( $C_m$ ).** In determining the kinetic energy of a berthing vessel, the effective or the virtual mass is the sum of vessel mass and hydrodynamic mass. The hydrodynamic mass does not necessarily vary with the mass of the vessel, but is closely related to the projected area of the vessel at right angles to the direction of motion.

Other factors, such as the form of vessel, water depth, berthing velocity, and acceleration or deceleration of the vessel, will have some effect on the hydrodynamic mass. Taking into account both model and prototype experiments, the effective or virtual mass coefficient can be estimated as:

$$C_m = 1 + 2 \cdot \frac{d_{actual}}{B} \quad (3-20)$$

where:

$d_{actual}$  = Actual arrival draft of the vessel

$B$  = Beam of vessel

The value of  $C_m$  for use in design should be a minimum of 1.5 and need not exceed 2.0 [3.26].

**3103F.6.7 Berthing velocity and angle.** The berthing velocity,  $V_m$ , is influenced by a large number of factors such as environmental conditions of the site (wind, current and wave), method of berthing (with or without tugboat assistance), condition of the vessel during berthing (ballast or fully laden) and human factors (experience of the tugboat captain).

The berthing velocity, normal to berth, shall be in accordance with Table 31F-3-9. Site condition is determined from Table 31F-3-10.

Subject to Division approval, if an existing MOT can demonstrate lower velocities by utilizing velocity monitoring equipment, then such a velocity may be used temporarily until the berthing system is compliant with this Code.

In order to obtain the normal berthing velocity,  $V_m$ , an approach angle, defined as the angle formed by the fender line and the longitudinal axis of the vessel must be determined. The berthing angles, used to compute the normal berthing velocity, for various vessel sizes are shown in Table 31F-3-11.

**TABLE 31F-3-11  
BERTHING ANGLE**

VESSEL SIZE (DWT)	ANGLE [degrees]
Barge	15
< 10,000	10
10,000-50,000	8
> 50,000	6

### 3103F.7 Wind and current loads on structures.

**3103F.7.1 General.** This section provides methods to determine the wind and current loads acting on the structure directly, as opposed to wind and current forces acting on the structure from a moored vessel.

**3103F.7.2 Wind loads.** Chapter 6 of ASCE 7[3.11] shall be used to establish minimum wind loads on the structure. Additional information about wind loads may be obtained from Simiu and Scanlan [3.29].

**3103F.7.3 Current loads.** The current forces acting on the structure may be established using the current velocities, per Section 3103F.5.3.

**3103F.8 Load combinations.** As a minimum, each component of the structure shall be analyzed for all applicable load combinations given in Table 31F-3-12 or 31F-3-13, depending on component type. For additional load combinations see "Piers and Wharves," DOD UFC 4-152-01 [3.26].

The "vacant condition" is the case wherein there is no vessel at the berth. The "mooring and breasting condition" exists after the vessel is securely tied to the wharf. The "berthing condition" occurs as the vessel impacts the wharf, and the "earthquake condition" assumes no vessel is at the berth, and there is no wind or current forces on the structure.

The use of various load types is discussed below:

**3103F.8.1 Dead load (D).** Upper and lower bound values of dead load are applied for the vacant condition to check the maximum moment and shear with minimum axial load.

**3103F.8.2 Live load (L).** The live load on MOTs is typically small and is therefore neglected for combinations including earthquake loads.

**3103F.8.3 Buoyancy load (B).** Buoyancy forces shall be considered for any submerged or immersed substructures (including pipelines, sumps and structural components).

**3103F.8.4 Wind (W) and current (C) on the structure.** Wind and currents on the vessel are included in the mooring and

**TABLE 31F-3-9  
BERTHING VELOCITY  $V_n$  (NORMAL TO BERTH)<sup>1</sup>**

VESSEL SIZE (DWT)	TUG BOAT ASSISTANCE	SITE CONDITIONS		
		Unfavorable	Moderate	Favorable
≤ 10,000	No	1.31 ft/sec	0.98 ft/sec	0.53 ft/sec
≤ 10,000	Yes	0.78 ft/sec	0.66 ft/sec	0.33 ft/sec
50,000	Yes	0.53 ft/sec	0.39 ft/sec	0.26 ft/sec
≥ 100,000	Yes	0.39 ft/sec	0.33 ft/sec	0.26 ft/sec

1. For vessel sizes not shown, interpolation between velocities may be used.

**TABLE 31F-3-10  
SITE CONDITIONS**

SITE CONDITIONS	DESCRIPTION	WIND SPEED <sup>1</sup>	SIGNIFICANT WAVE HEIGHT	CURRENT SPEED <sup>2</sup>
Unfavorable	Strong Wind Strong Currents High Waves	> 38 knots	> 6.5 ft	> 2 knots
Moderate	Strong Wind Moderate Current Moderate Waves	≥ 38 knots	≤ 6.5 ft	≤ 2 knots
Favorable	Moderate Wind Moderate Current Moderate Waves	< 38 knots	< 6.5 ft	< 2 knots

1. A 30-second duration measured at a height of 33 ft.

2. Taken at 0.5 x water depth

**TABLE 31F-3-12**  
**LRFD LOAD FACTORS FOR LOAD COMBINATIONS [3.26]**

LOAD TYPE	VACANT CONDITION		MOORING & BREASTING CONDITION	BERTHING CONDITION	EARTHQUAKE CONDITION <sup>3</sup>	
Dead Load (D)	1.2	0.9	1.2	1.2	$1.2 + k^1$	$0.9 - k^1$
Live Load (L)	1.6	—	$1.6^2$	1.0	1.0	—
Buoyancy (B)	1.2	0.9	1.2	1.2	$1.2^1$	$0.9^1$
Wind on Structure (W)	1.6	1.6	1.6	1.6	—	—
Current on Structure (C)	1.2	0.9	1.2	1.2	1.2	0.9
Earth Pressure on the Structure (H)	1.6	1.6	1.6	1.6	$1.6^4$	$1.6^4$
Mooring/Breasting Load (M)	—	—	1.6	—	—	—
Berthing Load ( $B_e$ )	—	—	—	1.6	—	—
Earthquake Load (E)	—	—	—	—	1.0	1.0

1.  $k = 0.50$  (PGA) The  $k$  factor ( $k=0.5$ (PGA)) and buoyancy (B) shall be applied to the vertical dead load (D) only, and not to the inertial mass of the structure.
2. The load factor for live load (L) may be reduced to 1.3 for the maximum outrigger float load from a truck crane.
3. For Level 1 and 2 earthquake conditions with strain levels defined in Division 7, the current on structure (C) may not be required.
4. An earth pressure on the Structure factor (H) of 1.0 may be used for pile or bulkhead structures.

**TABLE 31F-3-13**  
**SERVICE OR ASD LOAD FACTORS FOR LOAD COMBINATIONS [3.26]**

LOAD TYPE	VACANT CONDITION	MOORING & BREASTING CONDITION	BERTHING CONDITION	EARTHQUAKE CONDITION	
Dead Load (D)	1.0	1.0	1.0	$1 + 0.7k^1$	$1 - 0.7k^1$
Live Load (L)	1.0	1.0	0.75	—	—
Buoyancy (B)	1.0	1.0	1.0	1.0	0.6
Wind on Structure (W)	1.0	1.0	0.75	—	—
Current on Structure (C)	1.0	1.0	1.0	—	—
Earth Pressure on the structure (H)	1.0	1.0	1.0	1.0	1.0
Mooring/Breasting Load (M)	—	1.0	—	—	—
Berthing Load ( $B_e$ )	—	—	1.0	—	—
Earthquake Load (E)	—	—	—	0.7	0.7
% Allowable Stress	100	100	100	$100^2$	

1.  $k = 0.5$  (PGA)
2. Increase in allowable stress shall not be used with these load combinations unless it can be demonstrated that such increase is justified by structural behavior caused by rate or duration of load. See ASCE 7 [3.11]

breasting condition. The wind and current loads acting on the structure are therefore additional loads that can act simultaneously with the mooring, breasting and/or berthing loads.

**3103F.8.5 Earth pressure on the structure (H).** The soil pressure on end walls, typically concrete cut-off walls, steel sheet pile walls on wharf type structures and/or piles shall be considered.

**3103F.8.6 Mooring line/breasting loads (M).** Mooring line and breasting loads can occur simultaneously or individually, depending on the combination of wind and current. Multiple load cases for operating and survival conditions may be required (see Sections 3103F.5.2 and 3105F.2). In addition, loads caused by passing vessels shall be considered for the “mooring and breasting condition.” Refer to Sections 3105F.2 and 3105F.3 for the determination of mooring line and breasting loads.

**3103F.8.7 Berthing load ( $B_e$ ).** Berthing is a frequent occurrence, and shall be considered as a normal operating load. No increase in allowable stresses shall be applied for ASD.

**3103F.8.8 Earthquake loads (E).** Performance based seismic analysis methodology requires that the actual displacement demand be limited to defined strains in concrete, steel and timber. For the deck and pile evaluation, two cases of dead load (upper and lower bound) shall be considered in combination with the seismic load.

**3103F.9 Safety factors for mooring lines.** Safety factors for different material types of mooring lines are given in Table 31F-3-14. The safety factors should be applied to the minimum number of lines specified by the mooring analysis, using the highest loads calculated for the environmental conditions. The minimum breaking load (MBL) of new ropes is obtained from the certificate issued by the manufacturer. If nylon tails are used in combination with steel wire ropes, the safety factor shall be based on the weaker of the two ropes.

**3103F.10 Mooring hardware (N/E).** Mooring hardware shall include but not be limited to bollards, quick release hooks, other mooring fittings and base bolts. All mooring fittings shall be clearly marked with their safe working loads [3.13] (N). The certificate issued by the manufacturer normally defines the safe working loads of this hardware.

**TABLE 31F-3-14  
SAFETY FACTORS FOR ROPES\***

Steel Wire Rope	1.82
Nylon	2.2
Synthetic	2.0
Polyester Tail	2.3
Nylon Tail	2.5

\*From Mooring Equipment Guidelines', OCIMF[3.30]

**3103F.10.1 Quick release hooks.** For new MOTs or berthing systems, a minimum of three quick-release hooks are required for each breasting line location for tankers greater than or equal to 50,000 DWT. At least two hooks at each location shall be provided for breasting lines for tankers less than 50,000 DWT. Remote release may be considered for emergency situations.

All hooks and supporting structures shall withstand the minimum breaking load (MBL) of the strongest line with a safety factor of 1.2 or greater. Only one mooring line shall be placed on each quick release hook (N/E).

For multiple quick release hooks, the minimum horizontal load for the design of the tie-down shall be:

$$F_d = 1.2 \times \text{MBL} \times [1 + 0.75(n-1)] \quad (3-21)$$

$F_d$  = Minimum factored demand for assembly tie-down.

$n$  = Number of hooks on the assembly.

The capacity of the supporting structures must be larger than  $F_d$  (See Section 3103F.5).

**3103F.10.2 Other fittings.** Other fittings include cleats, bitts and bollards.

If the allowable working loads for existing fittings are not available, the values listed in Table 31F-3-15 may be used for typical sizes, bolt patterns and layout. The allowable working loads are defined for mooring line angles up to 60 degrees from the horizontal. The combination of vertical and horizontal loads must be considered.

**TABLE 31F-3-15  
ALLOWABLE WORKING LOADS**

TYPE OF FITTINGS	NO. OF BOLTS	BOLT SIZE (in)	WORKING LOAD (kips)
30 in. Cleat	4	1 <sup>1</sup> / <sub>8</sub>	20
42 in. Cleat	6	1 <sup>1</sup> / <sub>8</sub>	40
Low Bitt	10	1 <sup>5</sup> / <sub>8</sub>	60 per column
High Bitt	10	1 <sup>3</sup> / <sub>4</sub>	75 per column
44 1/2 in. Fit. Bollard	4	1 <sup>3</sup> / <sub>4</sub>	70
44 1/2 in. Fit. Bollard	8	2 <sup>1</sup> / <sub>4</sub>	200
48 in. Fit. Bollard	12	2 <sup>3</sup> / <sub>4</sub>	450

Note: This table is modified from Table 6-11, UFC 4-159-03 [3.17]

**3103F.10.3 Base bolts.** Base bolts are subjected to both shear and uplift. Forces on bolts shall be determined using the following factors:

1. Height of load application on bitts or bollards.

2. Actual vertical angles of mooring lines for the highest and lowest tide and vessel draft conditions, for all sizes of vessels at each particular berth.
3. Actual horizontal angles from the mooring line configurations, for all vessel sizes and positions at each particular berth.
4. Simultaneous loads from more than one vessel.

For existing MOTs, the deteriorated condition of the base bolts and supporting members shall be considered in determining the capacity of the fitting.

**3103F.11 Miscellaneous loads.** Handrails and guardrails shall be designed for 25 plf with a 200-pound minimum concentrated load in any location or direction.

### 3103F.12 Symbols.

- $a$  = Distance between the vessel's center of gravity and the point of contact on the vessel's side, projected onto the vessel's longitudinal axis [ft]
- $B$  = Beam of vessel
- $B_1$  = Coefficient used to adjust one-second period spectral response, for the effect of viscous damping
- $B_s$  = Coefficient used to adjust the short period spectral response, for the effect of viscous damping.
- $C_b$  = Berthing Coefficient
- $C_c$  = Configuration Coefficient
- $C_g$  = Geometric Coefficient
- $C_d$  = Deformation Coefficient
- $C_e$  = Eccentricity Coefficient
- $C_m$  = Effective mass or virtual mass coefficient
- $C_t$  = Windspeed conversion factor
- $DSA$  = Design Spectral Acceleration
- $DSA_d$  = DSA values at damping other than 5 percent
- $DT$  = Displacement of vessel
- $DWT$  = Dead weight tons
- $d_{actual}$  = Arrival maximum draft of vessel at berth
- $d_{max}$  = Maximum vessel draft (in open seas)
- $E_{fender}$  = Energy to be absorbed by the fender system
- $E_{vessel}$  = Berthing energy of vessel [ft-lbs]
- $F_a, F_v$  = Site coefficients from Tables 31F-3-5 and 31F-3-6
- $F_A$  = Accidental factor accounting for abnormal conditions
- $g$  = Acceleration due to gravity [32.2 ft/sec<sup>2</sup>]
- $h$  = Elevation above water surface [feet]
- $K$  = Current velocity correction factor (Fig 31F-3-4)
- $k$  = Radius of longitudinal gyration of the vessel [ft]
- $PGA_x$  = Peak ground acceleration corresponding to the Site Class under consideration.
- $s$  = Water depth measured from the surface
- $S_a$  = Spectral acceleration



- $S_I$  = Spectral acceleration value (for the boundary of  $S_B$  and  $S_c$ ) at 1.0 second
- $S_A-S_F$  = Site classes as defined in Table 31F-6-1
- $S_S$  = Spectral acceleration value (for the boundary of  $S_B$  and  $S_c$ ) at 0.2
- $S_{XI}$  = Spectral acceleration value at 1.0 second corresponding to the Site Class under consideration
- $S_{XS}$  = Spectral acceleration value at 0.2 second corresponding to the period of  $S_S$  and the Site Class under consideration
- $T$  = Draft of vessel (see Fig 31F-3-4)
- $T$  = Period (Sec)
- $T_0$  = Period at which the constant acceleration and constant velocity regions of the design spectrum intersect
- $V_c$  = Average current velocity [knots]
- $v_c$  = Current velocity as a function of depth [knots]
- $V_h$  = Wind speed (knots) at elevation  $h$
- $V_L$  = Over land wind speed
- $V_n$  = Berthing velocity normal to the berth [ft/sec]
- $v_t$  = Velocity over a given time period
- $V_{t=30\text{sec}}$  = Wind speed for a 30 second interval
- $V_w$  = Wind speed at 33ft. (10 m) elevation [knots]
- $W$  = Total weight of vessel and cargo in pounds [displacement tonnage  $\times$  2240]
- $WD$  = Water Depth (Fig 31F-3-4)

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## Division 4

### SECTION 3104F SEISMIC ANALYSIS AND STRUCTURAL PERFORMANCE

#### 3104F.1 General.

**3104F.1.1 Purpose.** The purpose of this section is to establish minimum standards for seismic analysis and structural performance. Seismic performance is evaluated at two criteria levels. Level 1 requirements define a performance criterion to ensure MOT functionality. Level 2 requirements safeguard against major structural damage or collapse.

**3104F.1.2 Applicability.** Section 3104F applies to all new and existing MOTs structures. Structures supporting loading arms, pipelines, oil transfer and storage equipment, critical nonstructural systems and vessel mooring structures, such as mooring and breasting dolphins are included. Catwalks and similar components that are not part of the lateral load carrying system and do not support oil transfer equipment may be excluded.

**3104F.1.3 Oil spill risk classification.** Each existing MOT shall be categorized into one of three risk classifications (high, medium or low) as shown in Table 31F-4-1, based on the highest of the following:

1. Exposed total volume of oil during transfer ("total volume" as calculated in Section 3108F.2.3)
2. Number of oil transfer operations per berthing system per year
3. Maximum vessel size (DWT) that may call at the berthing system

If risk reduction strategies (see Section 3101F.5) are adopted such that the maximum volume of exposed oil during transfer is less than 1,200 barrels, the classification level of the facility may be lowered. All new MOTs are classified as high risk.

**3104F.1.4 Configuration classification.** Each MOT shall be designated as regular or irregular, in accordance with Figure 31F-4-1.

Irregular configurations, such as the "T" layout, may be analyzed as regular if the presence of expansion joints divides the T-configuration into two or more regular segments. Expansion joints in this context are defined as joints that separate each structural segment in such a manner that each segment will move independently during an earthquake.

If an irregular MOT is divided into seismically isolated sections, an evaluation of the relative movement of pipelines

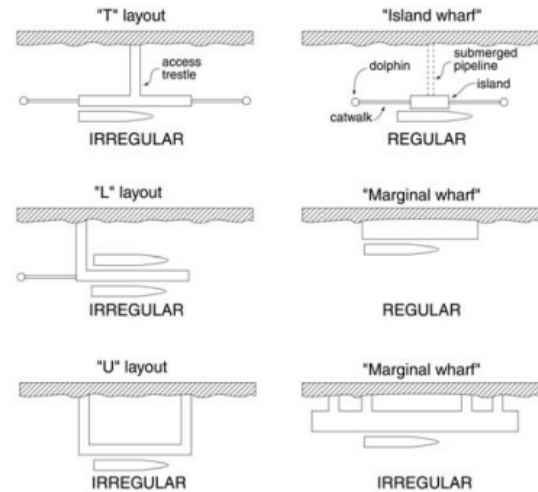


FIGURE 31F-4-1  
PIER AND WHARF CONFIGURATIONS

and supports shall be considered, including phase differences (Section 3109F.3).

#### 3104F.2 Existing MOTs

**3104F.2.1 Design earthquake motions.** Two levels of design seismic performance shall be considered. These levels are defined as follows:

##### Level 1 Seismic performance:

- Minor or no structural damage
- Temporary or no interruption in operations

##### Level 2 Seismic performance:

- Controlled inelastic structural behavior with repairable damage
- Prevention of structural collapse
- Temporary loss of operations, restorable within months
- Prevention of major spill ( $\geq 1200$  bbls)

**3104F.2.2 Basis for evaluation.** Component capacities shall be based on existing conditions, calculated as "best estimates," taking into account the mean material strengths, strain hardening and degradation overtime. The capacity of components with little or no ductility, which may lead to brittle failure scenarios, shall be calculated based on lower bound material strengths. Methods to establish component strength and deformation capacities for typical structural

TABLE 31F-4-1  
MOT RISK CLASSIFICATION

RISK CLASSIFICATION	EXPOSED OIL (bbis)	TRANSFERS PER YEAR PER BERTHING SYSTEM	MAXIMUM VESSEL SIZE (DWTx1000)
High	$\geq 1200$	N.A.	N.A.
Medium	$< 1200$	$\geq 90$	$\geq 30$
Low	$< 1200$	$< 90$	$< 30$

materials and components are provided in Section 3107F. Geotechnical considerations are discussed in Section 3106F.

**3104F.2.3 Analytical procedures.** The objective of the seismic analysis is to verify that the displacement capacity of the structure is greater than the displacement demand, for each performance level defined in Table 31F-4-2. The required analytical procedures are summarized in Table 31F-4-3.

The displacement capacity of the structure shall be calculated using the nonlinear static (pushover) procedure. It is also acceptable to use a nonlinear dynamic procedure for capacity evaluation. Methods used to calculate the displacement demand are linear modal, nonlinear static and nonlinear dynamic.

Any rational method, subject to the division's approval, can be used in lieu of the required analytical procedures shown in Table 31F-4-3.

**3104F.2.3.1 Nonlinear static capacity procedure (pushover).** Two-dimensional nonlinear static (pushover) analyses shall be performed; three-dimensional analyses are optional. A model that incorporates the nonlinear load deformation characteristics of all components for the lateral force-resisting system shall be displaced to a target displacement to determine the internal deformations and forces. The target displacement depends on the seismic performance level under consideration. Modeling details are as follows:

**3104F.2.3.1.1 Modeling.** A series of nonlinear pushover analyses may be required depending on the complexity of the MOT structure. At a minimum, pushover analysis of a two-dimensional model shall be conducted in both the longitudinal and transverse directions. The piles shall be represented by nonlinear elements that capture the moment-curvature/rotation relationships for components with expected inelastic behavior in accordance with Section 3107F. A nonlinear element is not required to represent each pile location. Piles with similar lateral force-deflection

behavior may be lumped in fewer larger springs, provided that the overall torsional effects are captured.

Linear material component behavior is acceptable where nonlinear response will not occur. All components shall be based on effective moment of inertia calculated in accordance with Section 3107F. Specific requirements for timber pile structures are discussed in the next section.

**3104F.2.3.1.2 Timber pile supported structures.** For all timber pile supported structures, linear elastic procedures may be used. Alternatively, the nonlinear static procedure may be used to estimate the target displacement demand,  $\Delta_d$ .

A simplified single pile model for a typical timber pile supported structure is shown in Figure 31F-4-2. The pile-deck connections may be assumed to be "pinned." The lateral bracing can often be ignored if it is in poor condition. These assumptions shall be used for the analysis, unless a detailed condition assessment and lateral analysis indicate that the existing bracing and connections may provide reliable lateral resistance.

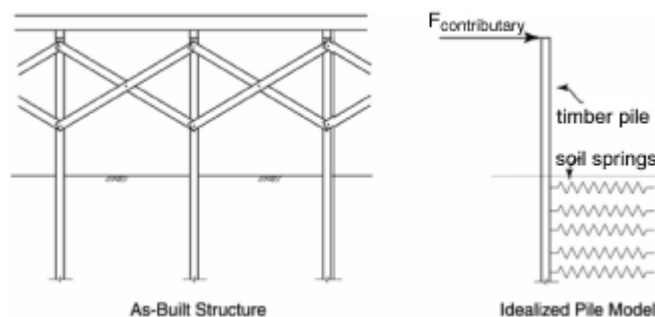


FIGURE 31F-4-2—SIMPLIFIED SINGLE PILE MODEL OF A TIMBER PILE SUPPORTED STRUCTURE

TABLE 31F-4-2  
SEISMIC PERFORMANCE CRITERIA

RISK CLASSIFICATION	SEISMIC PERFORMANCE LEVEL	PROBABILITY OF EXCEEDANCE	RETURN PERIOD
High	Level 1	50% in 50 years	72 years
	Level 2	10% in 50 years	475 years
Medium	Level 1	65% in 50 years	48 years
	Level 2	15% in 50 years	308 years
Low	Level 1	75% in 50 years	36 years
	Level 2	20% in 50 years	224 years

TABLE 31F-4-3  
MINIMUM REQUIRED ANALYTICAL PROCEDURES

RISK CLASSIFICATION	CONFIGURATION	SUBSTRUCTURE MATERIAL	DISPLACEMENT DEMAND PROCEDURE	DISPLACEMENT CAPACITY PROCEDURE
High/Medium	Irregular	Concrete/Steel	Linear Modal	Nonlinear Static
High/Medium	Regular	Concrete/Steel	Nonlinear Static	Nonlinear Static
Low	Regular/Irregular	Concrete/Steel	Nonlinear Static	Nonlinear Static
High/Medium/Low	Regular/Irregular	Timber	Nonlinear Static	Nonlinear Static

A series of single pile analyses may be sufficient to establish the nonlinear springs required for the pushover analysis.

**3104F.2.3.1.3 Soil-structure interaction (SSI).** Load-deformation characteristics for foundations shall be modeled as per Section 3106F.5. Selection of soil springs shall be based on the following:

1. Effect of the large difference in up and down slope stiffnesses for wharf type structures
2. Effect of upper and lower bound soil parameters, especially for t-z curves used to model batter pile behavior

A separate analysis that captures the demand (Section 3104F.2.3.2) on the piles due to permanent ground deformations, at embankments only, shall be performed.

If a simplified methodology is followed, the piles need to be checked for the following load combinations:

$$1.0E_{\text{inertial}}$$

$$1.0H_d + 0.25E_{\text{inertial}}$$

where:

$$E_{\text{inertial}} = \text{Inertial seismic load}$$

$$H_d = \text{Foundation deformation load}$$

**3104F.2.3.2 Nonlinear static demand procedure.** A nonlinear static procedure shall be used to determine the displacement demand for all concrete and steel structures, with the exception of irregular configurations with high or moderate seismic risk classifications. The following Sections (3104F.2.3.2.1 through 3104F.2.3.4) describe the procedure of Priestly et al. [4.1]; an alternate procedure is presented in ATC 40 [4.2], which is improved in FEMA 440 [4.3]. A linear modal procedure is required for irregular structures with high or moderate seismic risk classifications, and may be used for all other classifications in lieu of the nonlinear static procedure.

**3104F.2.3.2.1 Lateral stiffness.** The lateral stiffness,  $k$ , is calculated from the force-displacement relation as the total base shear,  $V_y$ , corresponding to the yield displacement of the structure  $\Delta_y$ .  $\Delta_y$  is the displacement at first yield in the pile/deck connection reinforcement.

**3104F.2.3.2.2 Structural period.** The fundamental period,  $T$ , of the structure in the direction under consideration shall be calculated as follows:

$$T = 2\pi \sqrt{\frac{m}{k}} \quad (4-1)$$

where:

$$m = \text{mass of structure in kips/g}$$

$$k = \text{stiffness in direction under consideration in kips/ft}$$

$$g = \text{gravity, } 32 \text{ ft/sec}^2 \text{ (9.8 meters/sec}^2\text{)}$$

**3104F.2.3.2.3 Target displacement demand.** The target displacement demand of the structure,  $\Delta_\phi$ , can be calculated by multiplying the spectral

response acceleration,  $S_A$ , corresponding to the period,  $T$ , by  $T^2/4\pi^2$ .

$$\Delta_d = S_A \frac{T^2}{4\pi^2} \quad (4-2)$$

If  $T < T_0$ , where  $T_0$  is the period corresponding to the peak of the acceleration response spectrum, a refined analysis (see Section 3104F.2.3.2.5) shall be used to calculate the displacement demand. Multidirectional excitation shall be addressed per Section 3104F.4.2.

**3104F.2.3.2.4 Damping.** The displacement demand established in Section 3104F.2.3.2.3 is based on 5 percent damping. Higher damping values obtained from a refined analysis may be used to calculate the displacement demand.

**3104F.2.3.2.5 Refined analyses.** Refined displacement demand analyses may be calculated as per Chapters 4 and 5 of [4.1] and is briefly summarized below.

1. Determine  $\Delta_d$ , from Section 3104F.2.3.2.3.
2. From the nonlinear pushover analysis, determine the structural yield displacement  $\Delta_y$ .
3. The ductility level,  $\mu_\Delta$ , is found from  $\Delta_d/\Delta_y$ . Use the appropriate relationship between ductility and damping, for the component undergoing inelastic deformation, to estimate the effective structural damping,  $\xi_{\text{eff}}$ . In lieu of more detailed analysis, the relationship shown in Figure 31F-4-3 or equation (4-3) may be used for concrete and steel piles connected to the deck through dowels embedded in the concrete.

$$\xi_{\text{eff}} = 0.05 + \frac{1}{\pi} \left( 1 - \frac{1-r}{\sqrt{\mu_\Delta}} - r\sqrt{\mu_\Delta} \right) \quad (4-3)$$

where:

$r$  = ratio of second slope over elastic slope (see Figure 31F-4-5)

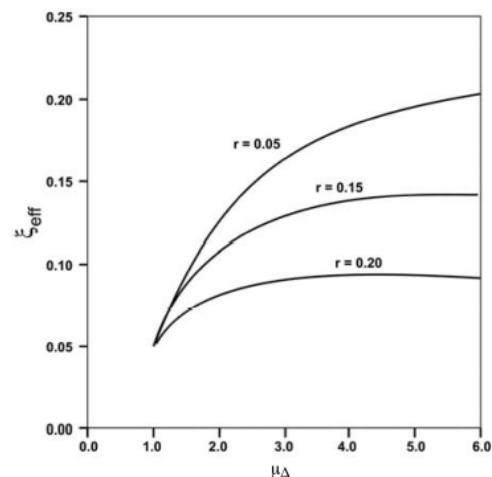


FIGURE 31F-4-3  
RELATION BETWEEN DUCTILITY,  $\mu_\Delta$ ,  
AND EFFECTIVE DAMPING,  $\xi_{\text{eff}}$  [4.1]

4. From the acceleration response spectra, create elastic displacement spectra,  $S_D$ , using equation (4-4) for various levels of damping.

$$S_D = \frac{T^2}{4\pi^2} S_A \quad (4-4)$$

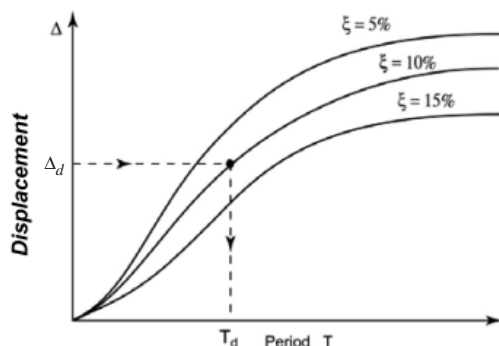


FIGURE 31F-4-4  
DESIGN DISPLACEMENT RESPONSE SPECTRA

5. Using the curve applicable to the effective structural damping,  $\xi$ , find the effective period,  $T_d$  (see Figure 31F-4-4).
6. In order to convert from a design displacement response spectra to another spectra for a different damping level, the adjustment factors in Section 3103F.4.2.9 shall be used.
7. The effective stiffness  $k_e$  can then be found from:

$$k_e = \frac{4\pi^2}{T_d^2} M \quad (4-5)$$

where:

$M$  = mass of deck considered in the analysis.  
 $T_d$  = effective structural period

8. The required strength  $F_u$  can now be estimated by:

$$F_u = k_e \Delta_d \quad (4-6)$$

9.  $F_u$  and  $\Delta_d$  can be plotted on the force-displacement curve established by the pushover analysis. Since this is an iterative process, the intersection of  $F_u$  and  $\Delta_d$  most likely will not fall on the force-displacement curve and a second iteration will be required. An adjusted value of  $\Delta_d$  taken as the intersection between the force-displacement curve and a line between the origin and  $F_u$  and  $\Delta_d$  can be used to find  $\mu_\Delta$ .
10. Repeat the process until a satisfactory solution is obtained (see Figure 31F-4-5).

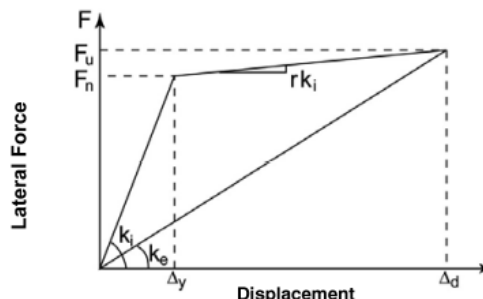


FIGURE 31F-4-5  
EFFECTIVE STIFFNESS,  $k_e$  [4.1]

**3104F.2.3.3 Linear modal demand procedure.** For irregular concrete/steel structures with moderate or high risk classifications, a linear analysis is required to predict the global displacement demands. A 3-D linear elastic response analysis shall be used, with effective moment of inertia applied to components to establish lateral displacement demands.

Sufficient modes shall be included in the analysis such that 90 percent of the participating mass is captured in each of the principal horizontal directions for the structure. For modal combinations, the complete quadratic combination rule shall be used. Multidirectional excitation shall be accounted for in accordance with Section 3104F.4.2.

The lateral stiffness of the linear elastic response model shall be based on the initial stiffness of the nonlinear pushover curve as shown in Figure 31F-4-6 (also see Section 3106F.5.1). The p-y springs shall be adjusted based on the secant method approach. Most of the p-y springs will typically be based on their initial stiffness; no iteration is required.

If the fundamental period in the direction under consideration is less than  $T_0$ , as defined in Section 3104F.2.3.2.3, then the displacement demand shall be amplified as specified in Section 3104F.2.3.2.5.

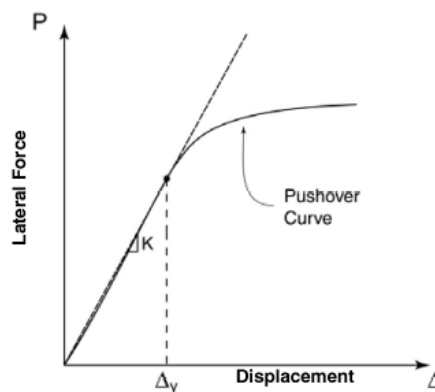


FIGURE 31F-4-6  
STIFFNESS FOR LINEAR MODAL ANALYSIS



**3104F.2.3.4 Nonlinear dynamic analysis.** Nonlinear dynamic time history analysis is optional, and if performed, a peer review is required (see Section 3101F.6.1). Multiple acceleration records shall be used, as explained in Section 3103F.4.2.10. The following assumptions may be made:

1. Equivalent “super piles” can represent groups of piles.
2. If the deck has sufficient rigidity (both in-plane and out-of plane) to justify its approximation as a rigid element, a 2-D plan simulation may be adequate.

A time-history analysis should always be compared with a simplified approach to ensure that results are reasonable. Displacements calculated from the nonlinear time history analyses may be used directly in design, but shall not be less than 80 percent of the values obtained from Section 3104F.2.3.2.

**3104F.2.3.5 Alternative procedures.** Alternative lateral-force procedures using rational analyses based on well-established principles of mechanics may be used in lieu of those prescribed in these provisions. As per Section 3101F.6.1, peer review is required.

**3104F.3 New MOTs.** The analysis and design requirements described in Section 3104F.2 shall also apply to new MOTs. Additional requirements are as follows:

1. Site-specific response spectra analysis (see Section 3103F.4.2.3).
2. Soil parameters based on site-specific and new borings (see Section 3106F.2.2).

#### 3104F.4 General analysis and design requirements.

**3104F.4.1 Load combinations.** Earthquake loads shall be used in the load combinations described in Section 3103F.8.

**3104F.4.2 Combination of orthogonal effects.** The design displacement demand,  $\Delta_d$ , shall be calculated by combining the longitudinal,  $\Delta_x$ , and transverse,  $\Delta_y$ , displacements in the horizontal plane (Figure 31F-4-7):

$$\Delta_d = \sqrt{\Delta_x^2 + \Delta_y^2} \quad (4-7)$$

where:

$$\Delta_x = \Delta_{xy} + 0.3\Delta_{xx} \quad (4-8)$$

$$\text{and } \Delta_y = 0.3\Delta_{yx} + \Delta_{yy} \quad (4-9)$$

or

$$\text{and } \Delta_y = \Delta_{yx} + 0.3\Delta_{yy} \quad (4-10)$$

$$\Delta_x = 0.3\Delta_{xy} + \Delta_{xx} \quad (4-11)$$

whichever results in the greater design displacement demand.

In lieu of combining the displacement demands as presented above, the design displacement demand for marginal wharf type MOTs may be calculated as:

$$\Delta_d = \Delta_y \sqrt{1 + (0.3(1 + 20e/L_l))^2} \quad (4-12)$$

where:

$\Delta_y$  = transverse displacement demand

$e$  = eccentricity between center of mass and center of rigidity

$L_l$  = longitudinal length between wharf expansion

This equation is only valid for wharf aspect ratios (length/breadth) greater than 3.

**3104F.4.3 P- $\Delta$  Effects.** The P- $\Delta$  effect (i.e., the additional moment induced by the total vertical load multiplied by the lateral deck deflection) shall be considered unless the following relationship is satisfied (see Figure 31F-4-8):

$$\frac{V}{W} \geq 4 \frac{\Delta_d}{H} \quad (4-13)$$

where:

$V$  = base shear strength of the structure obtained from a plastic analysis

$W$  = dead load of the frame

$\Delta_d$  = displacement demand

$H$  = distance from the location of maximum in-ground moment to center of gravity of the deck

For wharf structures where the lateral displacement is limited by almost fully embedded piles, P- $\Delta$  effects may be ignored; however, the individual stability of the piles shall be checked in accordance with Section 3107F.2.5.2.

If the landside batter piles are allowed to fail in a Level 2 evaluation, the remaining portion of the wharf shall be checked for P- $\Delta$  effects.

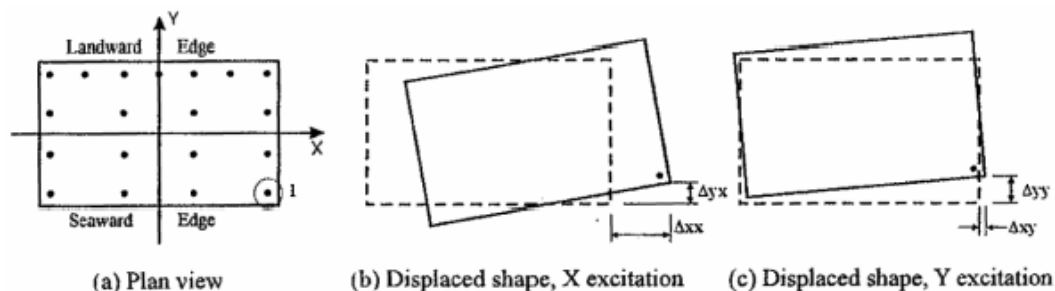


FIGURE 31F-4-7  
PLAN VIEW OF WHARF SEGMENT UNDER X AND Y SEISMIC EXCITATIONS [4.3]

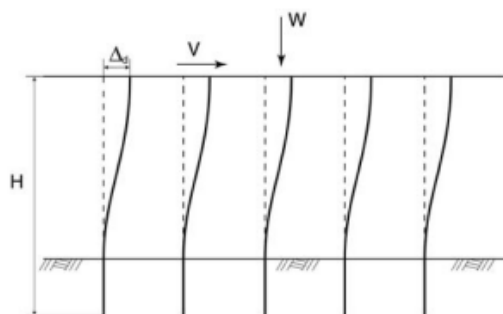


FIGURE 31F-4-8  
P-Δ EFFECT

**3104F.4.4 Expansion joints.** The effect of expansion joints shall be considered in the seismic analysis.

**3104F.4.5 Shear key forces.** Shear force across shear keys connecting adjacent wharf segments,  $V_{sk}$ , (approximate upper bound to the shear key force [4.4]) shall be calculated as follows:

$$V_{sk} = 1.5(e/L_l)V_{\Delta T} \quad (4-14)$$

where:

$V_{\Delta T}$  = total segment lateral force found from a push-over analysis

$L_l$  = segment length

$e$  = eccentricity between the center of rigidity and the center of mass

**3104F.4.6 Connections.** For an existing wharf, the deteriorated conditions at the junction between the pile top and pile cap shall be considered in evaluating the moment capacity. Connection detail between the vertical pile and pile cap shall be evaluated to determine whether full or partial moment capacity can be developed under seismic action.

For new MOTs, the connection details shall develop the full moment capacities.

The modeling shall simulate the actual moment capacity (full or partial) of the joint in accordance with Section 3107F.2. 7.

**3104F.4.7 Batter piles.** Batter piles primarily respond to earthquakes by developing large axial compression or tension forces. Bending moments are generally of secondary importance. Failure in compression may be dictated by the deck-pile connection (most common type), material compression, buckling, or by excessive local shear in deck members adjacent to the batter pile. Failure in tension may be dictated by connection strength or by pile pull out. (p. 3-83 of [4.4]).

When the controlling failure scenario is reached and the batter pile fails, the computer model shall be adjusted to consist of only the vertical pile acting either as a full or partial moment frame based on the connection details between the pile top and pile cap. The remaining displacement capacity, involving vertical piles, before the secondary failure stage develops, shall then be established (see Section 3107F.2.8).

Axial p-z curves shall be modeled. In compression, displacement capacity should consider the effect of the reduction in pile modulus of elasticity at high loads and the increase in effective length for friction piles. This procedure allows the pile to deform axially before reaching ultimate loads, thereby increasing the displacement ductility [4.4].

Horizontal nonlinear p-y springs are only applied to batter piles with significant embedment, such as for landside batter piles in a wharf structure. Moment fixity can be assumed for batter piles that extend well above the ground such as waterside batter piles in a wharf structure or batter piles in a pier type structure.

**3104F.5 Nonstructural components.** This section covers nonstructural components having a significant mass and/or a critical importance to the operability and safety of the MOT. The weight of nonstructural components shall be included in the dead load of the structure, per Section 3103F.2.

**3104F.5.1 Contribution to global response.** Nonstructural components including, but not limited to pipelines, loading arms, raised platforms, control rooms and vapor control equipment, may affect the global structural response. In such cases, the seismic characteristics (mass and/or stiffness) of the nonstructural components shall be considered. If the seismic response of nonstructural components is out of phase with the global structural response, then the mass contribution can be neglected in the seismic structural analysis.

**3104F.5.2 Seismic loads.** In general, for nonstructural components, the evaluation procedures of Section 3110F.8 are adequate.

For pipelines, the seismic analysis shall be performed in accordance with Section 3109F.3, in lieu of Section 3110F.8. If pipeline analysis has been performed and support reactions are available, they may be used to determine the forces on the support structure.

A pipeline segment under consideration shall extend between two adjacent anchor points. A simplified pipeline analysis may be used when the relative displacement demands of anchor points are considered. As an option, a full nonlinear time-history analysis can be used to capture the nonlinear interaction between the structure and the pipeline.

**3104F.5.3 Nonstructural critical systems assessment.** A seismic assessment of the survivability and continued operation during a Level 2 earthquake (see Table 31F-4-2) shall be performed for critical systems such as fire protection, emergency shutdown and electrical power systems. The assessment shall consider the adequacy and condition of anchorage, flexibility and seismically-induced interaction. For existing systems, seismic adequacy may be assessed per [4.5].

#### 3104F.6 Symbols.

$e$  = Eccentricity between center of mass and center of rigidity

$E_{inertial}$  = Inertial seismic load

$F_u$  = Required strength at maximum response

$H$  = Distance from maximum in-ground moment to center of gravity of the deck  
 $H_d$  = Foundation deformation load  
 $k$  = Stiffness in direction under consideration in k/ft  
 $k_e$  = Effective stiffness  
 $L_l$  = Longitudinal length between wharf expansion joints  
 $m$  = Mass of structure in kips/g  
 $M$  = Mass of deck considered in the analysis  
 $r$  = Ratio of second slope over elastic slope  
 $S_A$  = Spectral response acceleration, at  $T$   
 $S_D$  = Displacement response spectrum, at  $T$   
 $S_{ap}$  = Spectral response acceleration of pipeline segment under consideration  
 $T$  = Fundamental period of structure  
 $T_d$  = Effective structural period  
 $V$  = Base shear strength of the structure obtained from a plastic analysis  
 $V_y$  = total base shear  
 $V_{AT}$  = total segment lateral force  
 $V_{sk}$  = Shear force across shear keys  
 $W$  = Dead load of the frame  
 $W_p$  = Weight of pipeline segment under consideration  
 $\Delta_d$  = Design displacement demand  
 $\Delta_x$  = Longitudinal displacement demand  
 $\Delta_{xx}$  = X displacement under X direction excitation  
 $\Delta_{xy}$  = X displacement under Y direction excitation  
 $\Delta_y$  = Transverse displacement demand  
 $\Delta_{yx}$  = Y displacement under X direction excitation  
 $\Delta_{yy}$  = Y displacement under Y direction excitation  
 $\mu_\Delta$  = Ductility level

$\xi_{eff}$  or  $\xi$  = Effective structural damping

### 3104F.7 References.

- [4.1] Priestley, M.J.N., Sieble, F., Calvi, G.M., 1996, "Seismic Design and Retrofit of Bridges," John Wiley & Sons, Inc., New York, USA.
- [4.2] Applied Technology Council, ATC-40, 1996, "Seismic Evaluation and Retrofit of Concrete Buildings," Vols. 1 and 2, Redwood City, CA.
- [4.3] Applied Technology Council (ATC-55 Project), June 2005, "FEMA 440 Improvement of Nonlinear Static Seismic Analysis Procedures," Redwood City, CA.
- [4.4] Ferritto, J., Dickenson, S., Priestley N., Werner, S., Taylor, C., Burke D., Seelig W., and Kelly, S., 1999, "Seismic Criteria for California Marine Oil Terminals," Vol. 1 and Vol. 2, Technical Report TR-2103-SHR, Naval Facilities Engineering Service Center, Port Hueneme, CA.

[4.5] CalARP Program Seismic Guidance Committee, September 2009, "Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.

Authority: Sections 8755 and 8757, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.



## Division 5

## SECTION 3105F MOORING AND BERTHING ANALYSIS AND DESIGN

### 3105F.1 General.

**3105F.1.1 Purpose.** This section establishes minimum standards for safe mooring and berthing of vessels at MOTs.

**3105F.1.2 Applicability.** This section applies to onshore MOTs; Figure 31F-5-1 shows typical pier and wharf configurations.

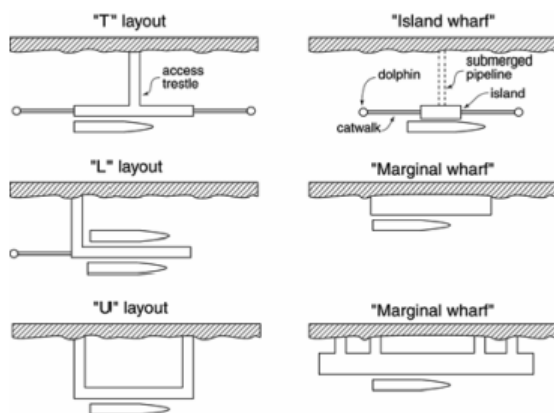


FIGURE 31F-5-1  
TYPICAL PIER AND WHARF CONFIGURATIONS

**3105F.1.3 Mooring/berthing requirements.** Multiple berth MOTs shall use the same conditions for each berth unless it can be demonstrated that there are significant differences.

MOTs shall have the following equipment in operation:

1. An anemometer (N/E).
2. A current meter in high velocity current ( $>1.5$  knots) areas (N/E).
3. Remote reading tension load devices in high velocity current ( $>1.5$  knots) areas and/or with passing vessel effects for new MOTs.
4. Mooring hardware in accordance with Section 3103F.10 (N/E).

Berthing systems shall be in accordance with Section 3105F.4 (N/E).

**3105F.1.4 New MOTs.** Quick release hooks are required at all new MOTs, except for spring line fittings. Quick release hooks shall be sized in accordance with Section 3103F.10. To avoid accidental release, the freeing mechanism shall be activated by a two-step process. Quick release hooks shall be insulated electrically from the mooring structure, and shall be supported so as not to contact the deck.

Section 3105F.5 and the OCIMF guidelines [5.4] shall be used in designing the mooring layout.

**3105F.1.5 Analysis and design of mooring components.** The existing condition of the MOT shall be used in the mooring analysis (see Section 3102F). Structural characteristics

of the MOT, including type and configuration of mooring fittings such as bollards, bitts, hooks and capstans and material properties and condition, shall be determined in accordance with Sections 3107F.4 and 3103F.10.

The analysis and design of mooring components shall be based on the loading combinations and safety factors defined in Sections 3103F.8 through 3103F.10, and in accordance with ACI 318 [5.1], AISC [5.2] and ANSI/AF&PA NDS [5.3], as applicable.

**3105F.2 Mooring analyses.** A mooring analysis shall be performed for each berthing system, to justify the safe berthing of the various deadweight capacities of vessels expected at the MOT. The forces acting on a moored vessel shall be determined in accordance with Section 3103F.5. Mooring line and breasting load combinations shall be in accordance with Section 3103F.8.

Two procedures, manual and numerical are available for performing mooring analyses. These procedures shall conform to either the OCIMF document, "Mooring Equipment Guidelines (MEG3)" [5.4] or the Department of Defense "Mooring" document [5.5]. The manual procedure (Section 3105F.2.1) may be used for barges.

A new mooring assessment shall be performed when conditions change, such as any modification in the mooring configuration, vessel size or new information indicating greater wind, current or other environmental loads.

In general, vessels shall remain in contact with the breasting or fendering system. Vessel motion (sway) of up to 2 feet off the breasting structure may be allowed under the most severe environmental loads, unless greater movement can be justified by an appropriate mooring analysis that accounts for potential dynamic effects. The allowable movement shall be consistent with mooring analysis results, indicating that forces in the mooring lines and their supports are within the allowable safety factors. Also, a check shall be made as to whether the movement is within the limitations of the cargo transfer equipment.

The most severe combination of the environmental loads has to be identified for each mooring component. At a minimum, the following conditions shall be considered:

1. Two current directions (maximum ebb and flood; See Section 3103F.5.3)
2. Two tide levels (highest high and lowest low)
3. Two vessel loading conditions (ballast and maximum draft at the terminal)
4. Eight wind directions (45 degree increments)

**3105F.2.1 Manual procedure.** Simplified calculations may be used to determine the mooring forces for barges with Favorable site conditions (see Table 31F-3-10) and no passing vessel effects (see Section 3105F.3.2), except if any of the following conditions exist (Figures 31F-5-2 and 31F-5-3, below).

1. Mooring layout is significantly asymmetrical
2. Horizontal mooring line angles ( $\alpha$ ) on bow and stern exceed 45 degrees

3. Horizontal breast mooring line angles exceed 15 normal to the hull
4. Horizontal spring mooring line angles exceed 10 degrees from a line parallel to the hull

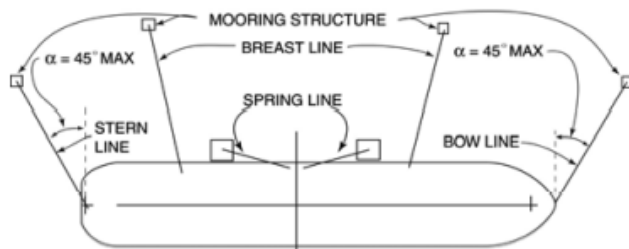


FIGURE 31F-5-2  
HORIZONTAL LINE ANGLES [5.4]

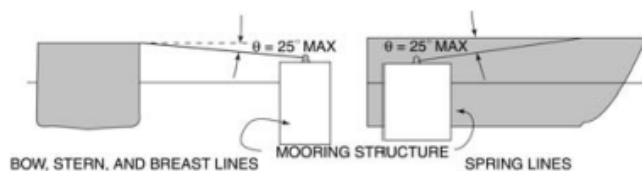


FIGURE 31F-5-3  
VERTICAL LINE ANGLES [5.4]

5. Vertical mooring line angles ( $\theta$ ) exceed 25 degrees
6. Mooring lines for lateral loads not grouped at bow and stern

When the forces have been determined and the distance between the bow and stern mooring points is known, the yaw moment can be resolved into lateral loads at the bow and stern. The total environmental loads on a moored vessel are comprised of the lateral load at the vessel bow, the lateral load at the vessel stern and the longitudinal load. Line pretension loads must be added.

Four load cases shall be considered:

1. Entire load is taken by mooring lines
2. Entire load is taken by breasting structures
3. Load is taken by combination of mooring lines and breasting structures
4. Longitudinal load is taken only by spring lines

**3105F.2.2 Numerical procedure.** A numerical procedure is required to obtain mooring forces for MOTs that cannot use manual procedure. Computer program(s) shall be based on mooring analysis procedures that consider the characteristics of the mooring system, calculate the environmental loads and provide resulting mooring line forces and vessel motions (surge and sway).

### 3105F.3 Wave, passing vessel, seiche and tsunami.

**3105F.3.1 Wind waves.** MOTs are generally located in sheltered waters such that typical wind waves can be assumed not to affect the moored vessel if the significant wave period,  $T_s$ , is less than 4 seconds. However, if the period is equal to or greater than 4 seconds, then a simplified dynamic analysis

(See Section 3103F.5.4) is required. The wave period shall be established based on a 1-year significant wave height,  $H_s$ . For MOTs within a harbor basin, the wave period shall be based on the locally generated waves with relatively short fetch.

**3105F.3.2 Passing vessels.** These forces generated by passing vessels are due to pressure gradients associated with the flow pattern. These pressure gradients cause the moored vessel to sway, surge, and yaw, thus imposing forces on the mooring lines.

Passing vessel analysis shall be conducted when all of the following conditions exist (See Figure 31F-5-4):

1. Passing vessel size is greater than 25,000 dwt.
2. Distance  $L$  is 500 feet or less
3. Vessel speed  $V$  is greater than  $V_{crit}$

where:

$$V_{crit} = 1.5 + \frac{L - 2B}{500 - 2B} 4.5 (\text{knots}) \quad (5-1)$$

**Exception:** If  $L \leq 2B$ , passing vessel loads shall be considered.

$L$  and  $B$  are shown in Figure 31F-5-4, in units of feet.  $V$  is defined as the speed of vessel over land minus the current velocity, when traveling with the current, or the speed of vessel over land plus the current velocity, when traveling against the current.

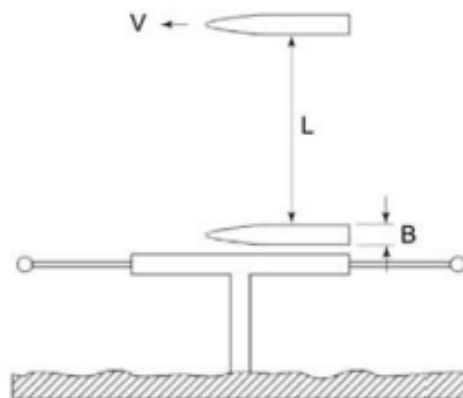


FIGURE 31F-5-4  
PASSING VESSEL

When such conditions (1, 2 and 3 above) exist, the surge and sway forces and the yaw moment acting on the moored vessel shall, as a minimum, be established in accordance with Section 3103F.5.5 or by dynamic analysis.

For MOTs located in ports, the passing distance,  $L$ , may be established based on channel width and vessel traffic patterns. The guidelines established in the Department of Defense, UFC 4-150-06, Figure 5-17 [5.6] for interior channels may be used. The "vertical bank" in Figure 5-17 of [5.6] shall be replaced by the side of the moored vessel when establishing the distance, " $L$ ."

For MOTs, not located within a port, the distance, “L,” must be determined from observed traffic patterns.

The following passing vessel positions shall be investigated:

1. Passing vessel is centered on the moored ship. This position produces maximum sway force.
2. The midship of the passing vessel is fore or aft of the centerline of the moored ship by a distance of 0.40 times the length of the moored ship. This position is assumed to produce maximum surge force and yaw moment at the same time.

The mooring loads due to a passing vessel shall be added to the mooring loads due to wind and current.

**3105F.3.3 Seiche.** A seiche analysis is required for existing MOTs located within a harbor basin and which have historically experienced seiche. A seiche analysis is required for new MOTs inside a harbor basin prone to penetration of ocean waves.

The standing wave system or seiche is characterized by a series of “nodes” and “antinodes.” Seiche typically has wave periods ranging from 20 seconds up to several hours, with wave heights in the range of 0.1 to 0.4 ft [5.6].

The following procedure may be used, as a minimum, in evaluating the effects of seiche within a harbor basin. In more complex cases where the assumptions below are not applicable, dynamic methods are required.

1. Calculate the natural period of oscillation of the basin. The basin may be idealized as rectangular, closed or open at the seaward end. Use Chapter 2 of UFC 4-150-06 [5.6] to calculate the wave period and length for different modes. The first three modes shall be considered in the analysis.
2. Determine the location of the moored ship with respect to the antinode and node of the first three modes to determine the possibility of resonance.
3. Determine the natural period of the vessel and mooring system. The calculation shall be based on the total mass of the system and the stiffness of the mooring lines in surge. The surge motion of the moored vessel is estimated by analyzing the vessel motion as a harmonically forced linear single degree of freedom spring mass system. Methods outlined in a paper by F.A. Kilner [5.7] can be used to calculate the vessel motion.
4. Vessels are generally berthed parallel to the channel; therefore, only longitudinal (surge) motions shall be considered, with the associated mooring loads in the spring lines. The loads on the mooring lines (spring lines) are then determined from the computed vessel motion and the stiffness of those mooring lines.

**3105F.3.4 Tsunami.** Run-up and current velocity shall be considered in the tsunami assessment. Table 31F-3-8 provides run-up values for the San Francisco Bay area, Los Angeles/Long Beach Harbors and Port Hueneme.

**3105F.4 Berthing analysis and design.** The analysis and design of berthing components shall be based on the loading combinations and safety factors defined in Sections 3103F.8 and 3103F.9 and in accordance with ACI 318 [5.1], AISI [5.2], and ANSI/AF&PA NDS [5.3], as applicable.

**3105F.4.1 Berthing energy demand.** The kinetic berthing energy demand shall be determined in accordance with Section 3103F.6.

**3105F.4.2 Berthing energy capacity.** For existing MOTs, the berthing energy capacity shall be calculated as the area under the force-deflection curve for the combined structure and fender system as indicated in Figure 31F-5-5. Fender piles may be included in the lateral analysis to establish the total force-deflection curve for the berthing system. Load-deflection curves for other fender types shall be obtained from manufacturer’s data. The condition of fenders shall be taken into account when performing the analysis.

When batter piles are present, the fender system typically absorbs most of the berthing energy. This can be established by comparing the force-deflection curves for the fender system and batter piles. In this case only the fender system energy absorption shall be considered.

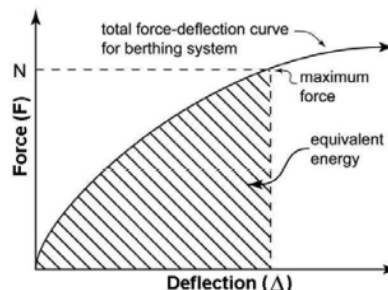


FIGURE 31F-5-5  
BERTHING ENERGY CAPACITY

#### 3105F.4.3 Tanker contact length.

**3105F.4.3.1 Continuous fender system.** A continuous fender system consists of fender piles, chocks, wales, and rubber or spring fender units.

The contact length of a ship during berthing depends on the spacing of the fender piles and fender units, and the connection details of the chocks and wales to the fender piles.

The contact length,  $L_c$  can be approximated by the chord formed by the curvature of the bow and the berthing angle as shown in Equation 5-2 below.

$$L_c = 2r \sin \alpha \quad (5-2)$$

where:

$L_c$  = contact length

$r$  = Bow radius

$\alpha$  = Berthing angle

In lieu of detailed analysis to determine the contact length, Table 31F-5-1 may be used. The contact length



for a vessel within the range listed in the table can be obtained by interpolation.

**TABLE 31F-5-1  
CONTACT LENGTH**

VESSEL SIZE (DWT)	CONTACT LENGTH
330	25 ft
1,000 to 2,500	35 ft
5,000 to 26,000	40 ft
35,000 to 50,000	50 ft
65,000	60 ft
100,000 to 125,000	70 ft

**3105F.4.3.2 Discrete fender system.** For discrete fender systems (i.e., not continuous), one fender unit or breasting dolphin shall be able to absorb the entire berthing energy.

**3105F.4.4 Longitudinal and vertical berthing forces.** The longitudinal and vertical components of the horizontal berthing force shall be calculated using appropriate coefficients of friction between the vessel and the fender. In lieu of as-built data, the values in Table 31F-5-2 may be used for typical fender/vessel materials:

**TABLE 31F-5-2  
COEFFICIENT OF FRICTION**

CONTACT MATERIALS	FRICTION COEFFICIENT
Timber to Steel	0.4 to 0.6
Urethane to Steel	0.4 to 0.6
Steel to Steel	0.25
Rubber to Steel	0.6 to 0.7
UHMW* to Steel	0.1 to 0.2

\*Ultra-high molecular weight plastic rubbing strips.

Longitudinal and vertical forces shall be determined by:

$$F = \mu N \quad (5-3)$$

where:

$F$  = longitudinal or vertical component of horizontal berthing force

$\mu$  = coefficient of friction of contact materials

$N$  = maximum horizontal berthing force (normal to fender)

**3105F.4.5 Design and selection of new fender systems.** For guidelines on new fender designs, refer to the Department of Defense "Piers and Wharves" document (UFC 4-152-01) [5.8] and the PIANC Guidelines for the Design of Fenders Systems: 2002 [5.9]. Also see Section 3103F.6.

**3105F.5 Layout of new MOTs.** The number and spacing of independent mooring dolphins and breasting dolphins depends on the DWT and length overall (LOA) of vessels to be accommodated.

Breasting dolphins shall be positioned adjacent to the parallel body of the vessel when berthed. A minimum of two breasting dolphins shall be provided. The spacing of breasting dolphins shall be adequate for all sizes of vessels that may berth at the MOT.

Mooring dolphins shall be set back from the berthing line (fender line) for a distance between 115 ft and 165 ft, so that longer bow, stern and breast lines can be deployed.

For a preliminary layout, the guidelines in the British Standards, Part 4, Section 2 [5.10], may be used in conjunction with the guidelines below.

1. If four breasting dolphins are provided, the spacing between exterior breasting dolphins shall be between 0.3 and 0.4 LOA of the maximum sized vessel expected to call at the MOT. The spacing between interior breasting dolphins shall be approximately 0.3 to 0.4 LOA of the minimum sized vessel expected to call at the MOT.
2. If only two breasting dolphins are provided, the spacing between the dolphins shall be the smaller (0.3 LOA) of the guidelines specified above.
3. If bow and stern lines are used for mooring, the spacing between exterior mooring dolphins shall be 1.35 times the LOA of the maximum sized vessel expected to call at the MOT.
4. The spacing between interior mooring dolphins shall be 0.8 times the LOA of the maximum sized vessel expected to call at the MOT.

The final layout of the mooring and breasting dolphins shall be determined based on the results of the mooring analysis that provides optimal mooring line and breasting forces for the range of vessels to be accommodated. The breasting force under the mooring condition shall not exceed the maximum fender reaction of the fender unit when it is being compressed at the manufacturers rated deflection.

### 3105F.6 Symbols.

$\alpha$  = Berthing angle. It also indicates the angle of horizontal mooring lines, see Fig 5-2.

$\Delta$  = Deflection

$\theta$  = Vertical mooring line angles

$B$  = Beam of vessel

$F$  = Longitudinal or vertical component of horizontal normal berthing force

$L$  = Distance between passing and moored vessels

$L_c$  = Contact length

$N$  = Maximum horizontal berthing force

$r$  = Bow radius

$\mu$  = Coefficient of friction of contact materials

$V$  = Ground speed (knots)

$V_c$  = Maximum current (knots).

$V_{crit}$  = Ground speed (knots) above which passing loads must be considered

$V_w$  = Maximum wind speed (knots)

### 3105F.7 References.

- [5.1] American Concrete Institute, ACI 318-05, 2005, "Building Code Requirements for Structural Concrete (318-05) and Commentary (318R-05)," Farmington Hills, Michigan.

- [5.2] *American Institute of Steel Construction Inc. (AISC), 2005, "Steel Construction Manual," Thirteenth Edition, Chicago, IL.*
- [5.3] *American Forest & Paper Association, 2005, "National Design Specification for Wood Construction," ANSI/AF&PA NDS-2005, Washington, D.C.*
- [5.4] *Oil Companies International Marine Forum (OCIMF), 2008, "Mooring Equipment Guidelines (MEG3)," 3<sup>rd</sup> Ed., London, England.*
- [5.5] *Department of Defense, 3 October 2005, "Mooring", Unified Facilities Criteria (UFC) 4-152-03, Washington D.C., USA.*
- [5.6] *Department of Defense, 12 December 2001, "Military Harbors and Coastal Facilities", Unified Facilities Criteria (UFC) 4-150-06, Washington D.C., USA.*
- [5.7] *Kilner F.A., 1961, "Model Tests on the Motion of Moored Ships Placed on Long Waves." Proceedings of 7th Conference on Coastal Engineering, August 1960, The Hague, Netherlands, published by the Council on Wave Research - The Engineering Foundation.*
- [5.8] *Department of Defense, 28 July 2005, "Piers and Wharves," Unified Facilities Criteria (UFC), 4-152-01, Washington D.C., USA.*
- [5.9] *Permanent International Association of Navigation Congresses (PIANC), 2002, "Guidelines for the Design of Fender Systems: 2002," Brussels.*
- [5.10] *British Standards Institution, 1994, "British Standard Code of Practice for Maritime Structures - Part 4. Code of Practice for Design of Fendering and Mooring Systems," BS6349, London, England.*

*Authority: Sections 8755 and 8757, Public Resources Code.*

*Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

## Division 6

### SECTION 3106F GEOTECHNICAL HAZARDS AND FOUNDATIONS

#### 3106F.1 General.

**3106F.1.1 Purpose.** This section provides minimum standards for analyses and evaluation of geotechnical hazards and foundations.

**3106F.1.2 Applicability.** The requirements provided herein apply to all new and existing MOTs.

**3106F.1.3 Seismic loading.** The seismic loading for geotechnical hazard assessment and foundation analyses is provided in Section 3103F.4.

#### 3106F.2 Site characterization.

**3106F.2.1 Site classes.** Each MOT shall be assigned at least one site class, based on site-specific geotechnical information. Site Classes  $S_A$ ,  $S_B$ ,  $S_C$ ,  $S_D$ , and  $S_E$  are defined in Table 31F-6-1 and Site Class  $S_F$  is defined as follows:

1. Soils vulnerable to significant potential loss of stiffness, strength, and/or volume under seismic loading, such as liquefiable soils, quick and highly sensitive clays, and collapsible weakly cemented soils.
2. Peats and/or highly organic clays, where the thickness of peat or highly organic clay exceeds 10 feet.
3. Very high plasticity clays with a plasticity index (PI) greater than 75, where depth of clay exceeds 25 feet.
4. Very thick soft/medium stiff clays, where the depth of clay exceeds 120 feet.

**3106F.2.2 Site-specific information.** In general, geotechnical characterization shall be based on site-specific information. This information may be obtained from existing or new sources. However, if existing or nonsite specific information is used, the geotechnical engineer of record shall provide adequate justification for its use.

Site-specific investigations shall include, at a minimum, borings and/or cone penetration tests, soil classifications, configuration, foundation loading and an assessment of seismic

hazards. The array (number and depths) of exploratory borings and cone penetration tests (CPT) will depend on the proposed or existing structures and site stratigraphy. The investigation or testing activities shall be completed following the procedures in Section 5 of SCEC [6.3]. CPT data may also be used by first converting to standard penetration test (SPT) data, using an appropriate method, that reflects the effects of soil gradation. If geotechnical data other than SPT and CPT are used, an adequate explanation and rationale shall be provided.

Quantitative soil information is required to a depth of 100 feet below the mudline, for assigning a Site Class (see Table 31F-6-1). When data to a depth of 100 feet is unavailable, other information such as geologic considerations may be used to determine the Site Class.

**3106F.3 Liquefaction.** A liquefaction assessment shall address triggering and the resulting hazards, using residual shear strengths of liquefied soils.

**3106F.3.1 Triggering assessment.** Liquefaction triggering shall be expressed in terms of the factor of safety (SF):

$$SF = CRR/CSR \quad (6-1)$$

where:

CRR = Cyclic Resistance Ratio

CSR = The Cyclic Stress Ratio induced by Design Peak Ground Acceleration (DPGA) or other postulated shaking

The CRR shall be determined from Figure 7.1 in SCEC [6.3]. If available, both the SPT and CPT data can be used.

CSR shall be evaluated using the simplified procedure in Section 3106F.3.1.1 or site-specific response analysis procedures in Section 3106F.3.1.2.

Shaking-induced shear strength reductions in liquefiable materials are determined as follows:

1.  $SF > 1.4$

Reductions of shear strength for the materials for postearthquake conditions may be neglected.

**TABLE 31F-6-1  
SITE CLASSES**

SITE CLASS	SOIL PROFILE NAME/GENERIC DESCRIPTION	AVERAGE VALUES FOR TOP 100 FEET OF SOIL PROFILE		
		Shear Wave Velocity, $V_s$ [ft/sec]	Standard Penetration Test [blows/ft]	Undrained Shear Strength, $S_u$ [psf]
$S_A$	Hard Rock	> 5,000	—	—
$S_B$	Rock	2,500 to 5,000	—	—
$S_C$	Very Stiff/Dense Soil and Soft Rock	1,200	> 50	> 2,000
$S_D$	Stiff/Dense Soil Profile	600 to 1,200	15 to 50	1,000 to 2,000
$S_E$	Soft/Loose Soil Profile	< 600	< 15	< 1,000
$S_F$	Defined in Section 3106F.2.1			

Notes:

1. Site Class SF shall require site-specific geotechnical information as discussed in Sections 3106F.2.2 and 3103F.4.
2. Site Class SE also includes any soil profile with more than 10 feet of soft clay defined as a soil with a plasticity index,  $PI > 20$ , water content  $> 40$  percent and  $S_u < 500$  psf.
3. The plasticity index, PI, and the moisture content shall be determined in accordance with ASTM D4318 [6.1] and ASTM D2216 [6.2], respectively.

2.  $1.0 < SF < 1.4$ 

A strength value intermediate to the material's initial strength and residual undrained shear strength should be selected based on the level of residual excess pore water pressure expected to be generated by the ground shaking (e.g., Figure 10 of Seed and Harder, [6.4]).

3.  $SF \leq 1.0$ 

Reduction of the material shear strength to a residual undrained shear strength level shall be considered, as described in Section 3106F.3.2.

**3106F.3.1.1 Simplified procedure.** The simplified procedure to evaluate liquefaction triggering shall follow Section 7 of SCEC [6.3]. Cyclic stress ratio (CSR) is used to define seismic loading, in terms of the Design Peak Ground Acceleration (DPGA) and Design Earthquake Magnitude (DEM). DPGA and DEM are addressed in Section 3103F.4.2. CSR is defined as:

$$CSR = 0.65 \left( \frac{DPGA}{g} \right) \left( \frac{\sigma_v}{\sigma'_v} \right) \left( \frac{r_d}{r_{MSF}} \right) \quad (6-2)$$

where:

$g$  = gravitational constant

$\sigma_v$  = the vertical total stress

$\sigma'_v$  = the vertical effective stress

$r_d$  = a stress reduction factor

$r_{MSF}$  = the magnitude scaling factor

For values of  $r_{MSF}$  and  $r_\phi$  see SCEC [6.3] Figures 7.2 and 7.3, respectively. To evaluate  $r_{MSF}$ , the DEM value associated with DPGA shall be used.

**3106F.3.1.2 Site specific response procedure.** In lieu of the simplified procedure, either one-dimensional or two-dimensional site response analysis may be performed using the ground motion parameters discussed in Section 3103F.4. The computed cyclic stresses at various points within the pertinent soil layers shall be expressed as values of CSR.

**3106F.3.2 Residual strength.** The residual undrained shear strength may be estimated from Figure 7.7 of SCEC [6.3]. When necessary, a conservative extrapolation of the range should be made. Under no circumstances, shall the residual shear strength be higher than the shear strength based on effective strength parameters.

The best estimate value should correspond to  $1/3$  from the lower bound of the range for a given value of equivalent clean sand SPT blowcount. When a value other than the " $1/3$  value" is selected for the residual shear strength, the selection shall be justified. An alternate method is provided in Stark and Mesri [6.5]. The residual strength of liquefied soils may be obtained as a function of effective confining pressures if a justification is provided. The resulting residual shear strength shall be used as the postearthquake shear strength of liquefied soils.

**3106F.4 Other geotechnical hazards.** For a  $SF$  less than 1.4, the potential for the following hazards shall be evaluated:

1. Flow slides
2. Slope movements
3. Lateral spreading
4. Ground settlement and differential settlement
5. Other surface manifestations

These hazards shall be evaluated, using the residual shear strength described above (Section 3106F.3.2).

**3106F.4.1 Stability of earth structures.** If a slope failure could affect the MOT, a stability analysis of slopes and earth retaining structures shall be performed. The analysis shall use limit equilibrium methods that satisfy all of the force and/or moment equilibrium conditions and determine the slope stability safety factor.

1. Slope stability safety factor  $\geq 1.2$

Flow slides can be precluded; however, seismically induced ground movements shall be addressed.

2.  $1.0 \leq$  Slope stability safety factor  $< 1.2$

Seismically induced ground movements should be evaluated using the methods described below.

3. Slope stability safety factor  $< 1.0$

Mitigation measures shall be implemented per Section 3106F.6.

**3106F.4.2 Simplified ground movement analysis.** The seismically induced ground settlement may be estimated using Section 7.6 of SCEC [6.3]. Surface manifestation of liquefaction may be evaluated using Section 7.7 of SCEC. Results shall be evaluated to determine if mitigation measures are required.

Seismically induced deformation or displacement of slopes shall be evaluated using the Makdisi-Seed [6.6] simplified method as described below.

The stability analysis shall be used with the residual shear strengths of soils to estimate the yield acceleration coefficient,  $K_y$ , associated with the critical potential movement plane. In general, the DPGA shall be used as  $K_{max}$  (see [6.6]) and DEM as the earthquake magnitude,  $M$ . These parameters shall be used together with the upper bound curves Figures 9-11 of [6.6], to estimate the seismically induced ground movement along the critical plane.

However, the value of  $K_{max}$  may be different from the DPGA value to include the effects of amplification, incoherence, etc. When such adjustments are made in converting DPGA to  $K_{max}$ , a justification shall be provided. Linear interpolation using the upper bound curves in Figure 10 (ordinate scale should be divided by 10) in [6.6] or Figure 4-10 in Ferritto et al [6.7] can be used to estimate the seismically induced ground movement for other earthquake magnitudes.

For the Ports of Los Angeles and Long Beach, Newmark displacement curves are available and are site-specific



[3.5, 3.6]. Curves are provided for both Level 1 and Level 2 earthquakes, and plot yield acceleration versus lateral displacement.

For screening purposes only, lateral spreading shall be evaluated, using the simplified equations in Youd et al. [6.8]. The total seismically induced ground displacement shall include all contributory directions.

1. When the resulting displacement from the screening method is  $> 0.1$  ft., the Makdisi-Seed simplified method or other similar methods shall be used to estimate lateral spreading.
2. If the computed displacement from the simplified method(s) is  $\leq 0.5$  ft., the effects can be neglected.
3. If the computed displacements using simplified methods are  $> 0.5$  ft., the use of a detailed ground movement analysis (see Section 3106F.4.3) may be considered.
4. If the final resulting displacement, regardless of the method used, remains  $> 0.5$  ft., it shall be considered in the structural analysis.

**3106F.4.3 Detailed ground movement analysis.** As an alternative to the simplified methods discussed above, a two-dimensional (2-D) equivalent linear or nonlinear dynamic analysis of the MOT and/or slopes and earth retaining systems may be performed.

An equivalent linear analysis is adequate when the stiffness and/or strength of the soils involved are likely to degrade by less than one-third, during seismic excitation of less than 0.5 g's. Appropriate time histories need to be obtained to calculate seismically induced displacement (see Section 3103F.4.2). Such analysis should account for the accumulating effects of displacement if double-integration of acceleration time histories is used. The seismic stresses or stress time histories from equivalent linear analysis may be used to estimate seismically induced deformation.

A nonlinear analysis should be used if the stiffness and/or strength of the soils involved are likely to degrade by more than one-third during seismic motion.

If the structure is included in the analysis, the ground motion directly affects the structural response. Otherwise, the uncoupled, calculated movement of the soil on the structure shall be evaluated.

**3106F.5 Soil structure interaction.** Two separate loading conditions for the piles shall be considered: (1) Inertial loading under seismic conditions, and (2) Kinematic loading from lateral ground spreading. Inertial loading is associated with earthquake-induced lateral loading on a structure, while kinematic loading refers to loading on foundation piles from earthquake induced lateral deformations of the slope/embankment/dike system. Simultaneous application of these loading conditions shall be evaluated with due consideration of the phasing and locations of these loads on foundation elements. The foundation design shall meet the structural perfor-

mance requirements of this Code, when subjected to both inertial and kinematic loadings.

**3106F.5.1 Soil parameters.** Soil structure interaction (SSI) shall be addressed for the seismic evaluation of MOT structures. SSI may consist of linear or non-linear springs (and possibly dash-pots) for various degrees of freedom, including horizontal, vertical, torsional, and rotational, as required by the structural analysis.

Pile capacity parameters may be evaluated using the procedures in Chapter 4 of FEMA 356 [6.9]. The "p-y" curves, "t-z" curves, and tip load — displacement curves for piles (nonlinear springs for horizontal and vertical modes and nonlinear vertical springs for the pile tip, respectively) and deep foundations shall be evaluated using Section 6 of API RP 2A-WSD [6.10] including the consideration of pile group effects. Equivalent springs (and dashpots) representing the degrading properties of soils may be developed.

Where appropriate, alternative procedures can be used to develop these parameters. Rationale for the use of alternative procedures shall be provided. One simplified method is presented in Chapter 4 of the UFC 3-220-01A [6.11] and provides deflection and moment for an isolated pile, subject to a lateral load.

**3106F.5.2 Shallow foundations.** Shallow foundations shall be assumed to move with the ground. Springs and dashpots may be evaluated as per Gazetas [6.12].

**3106F.5.3 Underground structures.** Buried flexible structures or buried portions of flexible structures including piles and pipelines shall be assumed to deform with estimated ground movement at depth.

As the soil settles, it shall be assumed to apply shear forces to buried structures or buried portions of structures including deep foundations.

**3106F.6 Mitigation measures and alternatives.** If the hazards and consequences addressed in Sections 3106F.3 and 3106F.4 are beyond the specified range, the following options shall be considered:

1. Perform a more sophisticated analysis
2. Modify the structure
3. Modify the foundation soil

Examples of possible measures to modify foundation soils are provided in Table 4-1 of [6.7].

#### 3106F.7 Symbols.

SF = Safety Factor

CRR = Cyclic Resistance Ratio

CSR = Cyclic Stress Ratio induced by DPGA

$g$  = Gravitational constant

$\sigma_v$  = the vertical total stress

$\sigma'_v$  = the vertical effective stress

$r_d$  = a stress reduction factor

$r_{MSF}$  = the magnitude scaling factor



**3106F.8 References.**

- [6.1] American Society for Testing and Materials (ASTM), 2002, "D4318-00 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," West Conshohocken, PA.
- [6.2] American Society for Testing and Materials (ASTM), 2002, "D2216-98 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass," West Conshohocken, PA.
- [6.3] Southern California Earthquake Center (SCEC), March 1999, "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction in California," University of Southern California, Los Angeles.
- [6.4] Seed, R.B. and Harder, C.F., 1999, SPT-Based Analysis of Cyclic Pore Pressure Generation and Undrained Residual Strength, *Proceedings of the H.B. Seed Memorial Symposium*, Editor: J.M. Duncan, BiTech Publishers Ltd., v. 2, pp. 351-376.
- [6.5] Stark, T.D., and Mesri, G., 1992, Undrained shear strength of liquefied sands for stability analysis, *Journal of Geotechnical Engineering, American Society of Civil Engineers*, v118, n11, pp 1727-1747.
- [6.6] Makdisi, F.I. and Seed, H.B., "Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations," *ASCE Journal of the Geotechnical Engineering Division*, Vol. 104, No. 7, pp. 849-867.
- [6.7] Ferritto, J., Dickenson, S., Priestley N., Werner, S., Taylor, C., Burke D., Seelig W., and Kelly, S., 1999, "Seismic Criteria for California Marine Oil Terminals," Vol.1 and Vol.2, *Technical Report TR-2103-SHR*, Naval Facilities Engineering Service Center, Port Hueneme, CA.
- [6.8] Youd, T. L., Hansen, C. M., and Bartlett, S. F., "Revised MLR Equations for Predicting Lateral Spread Displacement" *Proceedings of the 7th U.S.-Japan Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures Against Soil Liquefaction*, 1999."
- [6.9] Federal Emergency Management Agency, FEMA -356, Nov. 2000, "Prestandard and Commentary for the Seismic Rehabilitation of Buildings," Washington, D.C.
- [6.10] American Petroleum Institute, December 2000, *Recommended Practice 2A-WSD (API RP 2A-WSD)*, "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design," Washington, D.C.
- [6.11] Department of Defense, 16 January 2004, *Unified Facilities Criteria (UFC) 3-220-01A*, "Deep Foundations," Washington, D.C.
- [6.12] Gazetas, G., "Formulas and Charts for Impedances of Surface and Embedded Foundations," *Journal of Geotechnical Engineering, ASCE*, Vol. 117, No. 9, September, 1991.

Authority: Sections 8755 and 8757, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

## Division 7

### SECTION 3107F STRUCTURAL ANALYSIS AND DESIGN OF COMPONENTS

#### 3107F.1 General.

**3107F.1.1 Purpose.** This section establishes the minimum performance standards for structural components. Evaluation procedures for seismic performance, strength and deformation characteristics of concrete, steel and timber components are prescribed herein. Analytical procedures for structural systems are presented in Section 3104F.

**3107F.1.2 Applicability.** This section addresses MOTs constructed using the following structural components:

1. Reinforced concrete decks supported by batter and/or vertical concrete piles
2. Reinforced concrete decks supported by batter and/or vertical steel piles, including pipe piles filled with concrete
3. Reinforced concrete decks supported by batter and/or vertical timber piles
4. Timber decks supported by batter or vertical timber, concrete or steel pipe piles
5. Retaining structures constructed of steel, concrete sheet piles or reinforced concrete

#### 3107F.2 Concrete deck with concrete or steel piles.

**3107F.2.1 Component strength.** The following parameters shall be established in order to compute the component strength:

1. Specified concrete compressive strengths
2. Concrete and steel modulus of elasticity
3. Yield and tensile strength of mild reinforcing and prestressed steel and corresponding strains
4. Confinement steel strength and corresponding strains
5. Embedment length
6. Concrete cover
7. Yield and tensile strength of structural steel
8. Ductility

In addition, for “existing” components, the following conditions shall be considered:

9. Environmental effects, such as reinforcing steel corrosion, concrete spalling, cracking and chemical attack
10. Fire damage
11. Past and current loading effects, including overload, fatigue or fracture
12. Earthquake damage
13. Discontinuous components
14. Construction deficiencies

**3107F.2.1.1 Material properties.** Material properties of existing components, not determined from testing procedures, and of new components, shall be established using the following methodology.

The strength of structural components shall be evaluated based on the following values (Section 5.3 of [7.1] and pp. 3-73 and 3-74 of [7.2]):

Specified material strength shall be used for nonductile components (shear controlled), all mechanical, electrical and mooring equipment (attachments to the deck) and for all non seismic load combinations:

$$f'_c = 1.0f'_c \quad (7-1a)$$

$$f_y = 1.0f_y \quad (7-1b)$$

$$f_p = 1.0f_p \quad (7-1c)$$

In addition, these values (7-1a, 7-1b and 7-1c) may be used conservatively as alternatives to determine the nominal strength of ductile components (N).

Expected lower bound estimates of material strength shall be used for determination of moment-curvature relations and nominal strength of all ductile components:

$$f'_c = 1.3f'_c \quad (7-2a)$$

$$f_y = 1.1f_y \quad (7-2b)$$

$$f_p = 1.0f_p \quad (7-2c)$$

Upper bound estimates of material strength shall be used for the determination of moment-curvature relations, to obtain the feasible maximum demand on capacity protected members:

$$f'_c = 1.7f'_c \quad (7-3a)$$

$$f_y = 1.3f_y \quad (7-3b)$$

$$f_p = 1.1f_p \quad (7-3c)$$

**where:**

$f'_c$  = Specified compressive strength of concrete

$f_y$  = Specified yield strength of reinforcement or specified minimum yield stress steel

$f_p$  = Specified yield strength of prestress strands

“Capacity Design” (Section 5.3 of [7.1]) ensures that the strength at protected components (such as pile caps and decks), joints and actions (such as shear), is greater than the maximum feasible demand (over strength), based on realistic upper bound estimates of plastic hinge flexural strength. An additional series of nonlinear analyses using moment curvature characteristics of pile hinges may be required.

Alternatively, if a moment-curvature analysis is performed that takes into account the strain hardening of the steel, the demands used to evaluate the capacity protected components may be estimated by multiplying the moment-curvature values by 1.25.

Based on a historical review of the building materials used in the twentieth century, guidelines for tensile and yield properties of concrete reinforcing bars and the compressive strength of structural concrete have been established (see Tables 6-1 to 6-3 of FEMA 356 [7.3]). The values shown in these tables can be used as default properties, only if as-built information is not available and testing is not performed. The values in Tables 31F-7-1 and 31F-7-2, are adjusted according to equations (7-1) through (7-3).

**3107F.2.1.2 Knowledge factor (k).** Knowledge factor, *k*, shall be applied on a component basis.

The following information is required, at a minimum, for a component strength assessment:

1. Original construction records, including drawings and specifications.

2. A set of “as-built” drawings and/or sketches, documenting both gravity and lateral systems (Section 3102F.1.5) and any postconstruction modification data.
3. A visual condition survey, for structural components including identification of the size, location and connections of these components.
4. In the absence of material properties, values from limited in-situ testing or conservative estimates of material properties (Tables 31F-7-1 and 31F-7-2).
5. Assessment of component conditions, from an in-situ evaluation, including any observable deterioration.
6. Detailed geotechnical information, based on recent test data, including risk of liquefaction, lateral spreading and slope stability.

**TABLE 31F-7-1**  
**COMPRESSIVE STRENGTH OF STRUCTURAL CONCRETE (psi)<sup>1</sup>**

TIME FRAME	PILING	BEAMS	SLABS
1900-1919	2,500-3,000	2,000-3,000	1,500-3,000
1920-1949	3,000-4,000	2,000-3,000	2,000-3,000
1950-1965	4,000-5,000	3,000-4,000	3,000-4,000
1966-present	5,000-6,000	3,000-5,000	3,000-5,000

1. Concrete strengths are likely to be highly variable for an older structure.

**TABLE 31F-7-2**  
**TENSILE AND YIELD PROPERTIES OF REINFORCING BARS FOR VARIOUS ASTM SPECIFICATIONS AND PERIODS**  
**(after Table 6-2 of [7.3])**

ASTM	STEEL TYPE	YEAR RANGE <sup>3</sup>	GRADE	STRUCTURAL <sup>1</sup>	INTERMEDIATE <sup>1</sup>	HARD <sup>1</sup>			
				33	40	50	60	70	75
				Minimum Yield <sup>2</sup> (psi)	40,000	50,000	60,000	70,000	75,000
				Minimum Tensile <sup>2</sup> (psi)	70,000	80,000	90,000	95,000	100,000
A15	Billet	1911-1966		X	X	X			
A16	Rail <sup>4</sup>	1913-1966				X			
A61	Rail <sup>4</sup>	1963-1966					X		
A160	Axle	1936-1964		X	X	X			
A160	Axle	1965-1966		X	X	X	X		
A408	Billet	1957-1966		X	X	X			
A431	Billet	1959-1966							X
A432	Billet	1959-1966					X		
A615	Billet	1968-1972			X		X		X
A615	Billet	1974-1986			X		X		
A615	Billet	1987-1997			X		X		X
A616	Rail <sup>4</sup>	1968-1997				X	X		
A617	Axle	1968-1997			X		X		
A706	Low-Alloy <sup>5</sup>	1974-1997						X	
A955	Stainless	1996-1997			X		X		X

General Note: An entry “X” indicates that grade was available in those years.

1. The terms structural, intermediate and hard became obsolete in 1968.

2. Actual yield and tensile strengths may exceed minimum values.

3. Until about 1920, a variety of proprietary reinforcing steels were used. Yield strengths are likely to be in the range from 33,000 psi to 55,000 psi, but higher values are possible. Plain and twisted square bars were sometimes used between 1900 and 1949.

4. Rail bars should be marked with the letter “R.”

5. ASTM steel is marked with the letter “W.”

The knowledge factor,  $k$ , is 1.0 when comprehensive knowledge as specified above is utilized. Otherwise, the knowledge factor shall be 0.75 (see Table 2-1 of FEMA 356 [7.3]).

**3107F.2.2 Component stiffness.** Stiffness that takes into account the stress and deformation levels experienced by the component shall be used. Nonlinear load-deformation relations shall be used to represent the component load-deformation response. However, in lieu of using nonlinear methods to establish the stiffness and moment curvature relation of structural components, the equations of Table 31F-7-3 may be used to approximate the effective elastic stiffness,  $EI_e$ , for lateral analyses (see Section 3107F.5 for definition of symbols).

**TABLE 31F-7-3  
EFFECTIVE ELASTIC STIFFNESS**

CONCRETE COMPONENT	$EI_e / EI_g$
Reinforced Pile	$0.3 + N/(f'_c A_g)$
Pile/Deck Dowel Connection <sup>1</sup>	$0.3 + N/(f'_c A_g)$
Prestressed Pile <sup>1</sup>	$0.6 < EI_e / EI_g < 0.75$
Steel Pile	1.0
Concrete w/ Steel Casing	$\frac{E_s I_s + 0.25 E_c I_c}{(E_s I_s + E_c I_c)}$
Deck	0.5

1. The pile/deck connection and prestressed pile may also be approximated as one member with an average stiffness of  $0.42 EI_e / EI_g$  (Ferritto et al, 1999 [7.2])

$N$  = is the axial load level.

$E_s$  = Young's modulus for steel

$I_s$  = Moment of inertia for steel section

$E_c$  = Young's modulus for concrete

$I_c$  = Moment of inertia for uncracked concrete section

**3107F.2.3 Deformation capacity of flexural members.** Stress-strain models for confined and unconfined concrete, mild and prestressed steel presented in Section 3107F.2.4 shall be used to perform the moment-curvature analysis.

The stress-strain characteristics of steel piles shall be based on the actual steel properties. If as-built information is not available, the stress-strain relationship may be obtained per Section 3107F.2.4.2.

For concrete in-filled steel piles, the stress-strain model for confined concrete shall be in accordance with Section 3107F.2.4.1.

Each structural component expected to undergo inelastic deformation shall be defined by its moment-curvature relation. The displacement demand and capacity shall be calculated per Sections 3104F.2 and 3104F.3, as appropriate.

The moment-rotation relationship for concrete components shall be derived from the moment-curvature analysis per Section 3107F.2.5.4 and shall be used to determine lateral displacement limitations of the design. Connection details shall be examined per Section 3107F.2.7.

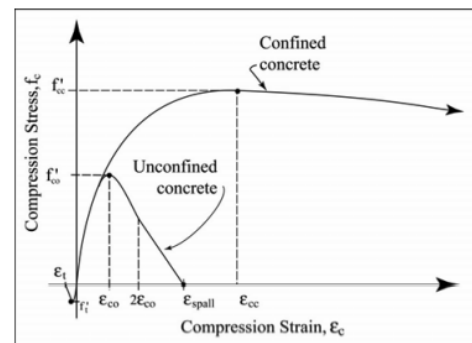
### 3107F.2.4 Stress-Strain models.

**3107F.2.4.1 Concrete.** The stress-strain model and terms for confined and unconfined concrete are shown in Figure 31F-7-1.

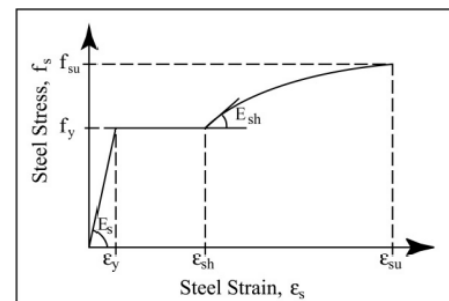
**3107F.2.4.2 Reinforcement steel and structural steel.** The stress-strain model and terms for reinforcing and structural steel are shown in Figure 31F-7-2.

**3107F.2.4.3 Prestressed steel.** The stress-strain model of Blakeley and Park [7.4] may be used for prestressed steel. The model and terms are illustrated in Figure 31F-7-3.

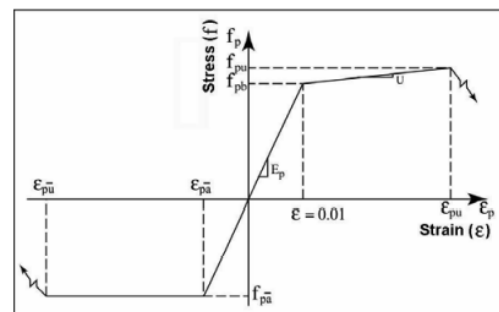
**3107F.2.4.4 Alternative stress-strain models.** Alternative stress-strain models are acceptable if adequately documented and supported by test results, subject to Division approval.



**FIGURE 31F-7-1  
STRESS-STRAIN CURVES FOR CONFINED  
AND UNCONFINED CONCRETE [7.1]**



**FIGURE 31F-7-2  
STRESS-STRAIN CURVE FOR MILD REINFORCING STEEL OR  
STRUCTURAL STEEL [7.1]**



**FIGURE 31F-7-3  
STRESS-STRAIN CURVE FOR PRESTRESSED STEEL [7.4]**



**3107F.2.5 Concrete piles.**

**3107F.2.5.1 General.** The capacity of concrete piles is based on permissible concrete and steel strains corresponding to the desired performance criteria.

Different values may apply for plastic hinges forming at in-ground and pile-top locations. These procedures are applicable to circular, octagonal, rectangular and square pile cross sections.

**3107F.2.5.2 Stability.** Stability considerations are important to pier-type structures. The moment-axial load interaction shall consider effects of high slenderness ratios ( $kl/r$ ). An additional bending moment due to axial load eccentricity shall be incorporated unless:

$$e/h \leq 0.10 \quad (7-4)$$

where:

$e$  = eccentricity of axial load

$h$  = width of pile in considered direction

**3107F.2.5.3 Plastic hinge length.** The plastic hinge length is required to convert the moment-curvature relationship into a moment-plastic rotation relationship for the nonlinear pushover analysis.

The pile's plastic hinge length,  $L_p$  (above ground), when the plastic hinge forms against a supporting member is:

$$L_p = 0.08L + 0.15f_{ye} d_{bl} \geq 0.3f_{ye} d_{bl} \quad (7-5)$$

where:

$L$  = the distance from the critical section of the plastic hinge to the point of contraflexure

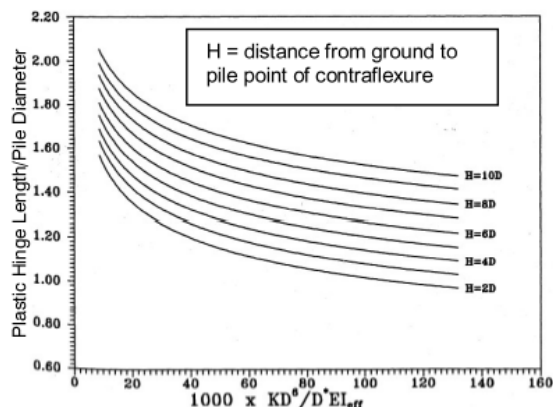
$d_{bl}$  = the diameter of the longitudinal reinforcement

$f_{ye}$  = design yield strength of longitudinal reinforcement (ksi)

If a large reduction in moment capacity occurs due to spalling, then the plastic hinge length shall be:

$$L_p = 0.3f_{ye} d_{bl} \quad (7-6)$$

When the plastic hinge forms in-ground, the plastic hinge length may be determined from Figure 31F-7-4 (see page 311 of [7.1]).



**FIGURE 31F-7-4**  
**INFLUENCE OF PILE/SOIL STIFFNESS RATIO ON PLASTIC HINGE LENGTH (after Fig. 5.30 of [7.1])**

The stiffness parameter ( $x$ -axis) is:

$$\frac{KD^6}{[D^*]EI_e} \quad (7-7)$$

where:

$EI_e$  = the effective stiffness

$K$  = the subgrade modulus

$D$  = pile diameter

$D^*$  = reference diameter of 6 ft

If site specific soil information is not available then the values for  $K$  in Table 31F-7-4 may be used.

**TABLE 31F-7-4**  
**SUBGRADE MODULUS  $K$**

SOIL TYPE	AVG UNDRAINED SHEAR STRENGTH [psf]	SUBGRADE MODULUS $K$ [lb/in <sup>3</sup> ]
Soft Clay	250-500	30
Medium Clay	500-1000	100
Stiff Clay	1000-2000	500
Very Stiff Clay	2000-4000	1000
Hard Clay	4000-8000	2000
Loose Sand (above WT/submerged)	—	25/20
Medium Sand (above WT/submerged)	—	90/60
Sand (above WT/submerged)	—	275/125

**3107F.2.5.4 Plastic rotation.** The plastic rotation,  $\theta_p$ , can be determined from Equation 7-8, by using moment-curvature analysis and applicable strain limitations, as shown in Figure 31F-7-5.

The plastic rotation is:

$$\theta_p = L_p \phi_p = L_p (\phi_m - \phi_y) \quad (7-8)$$

where:

$L_p$  = plastic hinge length

$\phi_p$  = plastic curvature

$\phi_m$  = maximum curvature

$\phi_y$  = yield curvature

The maximum curvature,  $\phi_m$  shall be determined by the concrete or steel strain limit state at the prescribed performance level, whichever comes first.

Alternatively, the maximum curvature,  $\phi_m$  may be calculated as:

$$\phi_m = \frac{\epsilon_{cm}}{C_u} \quad (7-9)$$

where:

$\epsilon_{cm}$  = max limiting compression strain for the prescribed performance level (Table 31F-7-5)

$C_u$  = neutral-axis depth, at ultimate strength of section

The yield curvature,  $\phi_y$ , is the curvature at the intersection of the secant stiffness,  $EI_c$ , through first yield and the nominal strength, ( $\epsilon_c = 0.004$ )

$$\phi_y = \frac{M_y}{EI_c} \quad (7-10)$$

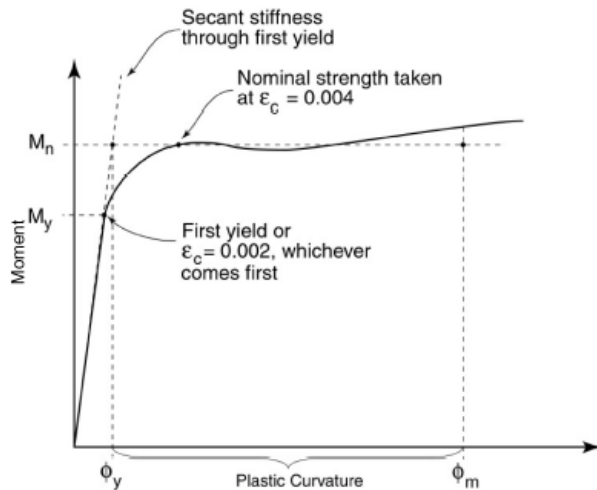


FIGURE 31F-7-5  
MOMENT CURVATURE ANALYSIS

**3107F.2.5.5 Ultimate concrete and steel flexural strains.** Strain values computed in the nonlinear push-over analysis shall be compared to the following limits.

**3107F.2.5.5.1 Unconfined concrete piles:** An unconfined concrete pile is defined as a pile having no confinement steel or one in which the spacing of the confinement steel exceeds 12 inches.

Ultimate concrete compressive strain:

$$\epsilon_{cu} = 0.005 \quad (7-11)$$

**3107F.2.5.5.2 Confined concrete piles:**

Ultimate concrete compressive strain [7.1]:

$$\epsilon_{cu} = 0.004 + (1.4\rho_s f_{yh} \epsilon_{sm}) / f'_{cc} \geq 0.005 \quad (7-12)$$

$$\epsilon_{cu} \leq 0.025$$

where:

$\rho_s$  = effective volume ratio of confining steel

$f_{yh}$  = yield stress of confining steel

$\epsilon_{sm}$  = strain at peak stress of confining reinforcement, 0.15 for grade 40, 0.10 for grade 60

$f'_{cc}$  = confined strength of concrete approximated by  $1.5 f'_c$

**3107F.2.5.6 Component acceptance/damage criteria.** The maximum allowable concrete strains may not exceed the ultimate values defined in Section 3107F.2.5.5. The following limiting values (Table 31F-7-5) apply for each performance level for both existing and new structures. The "Level 1 or 2" refer to the seismic performance criteria (see Section 3104F.2.1).

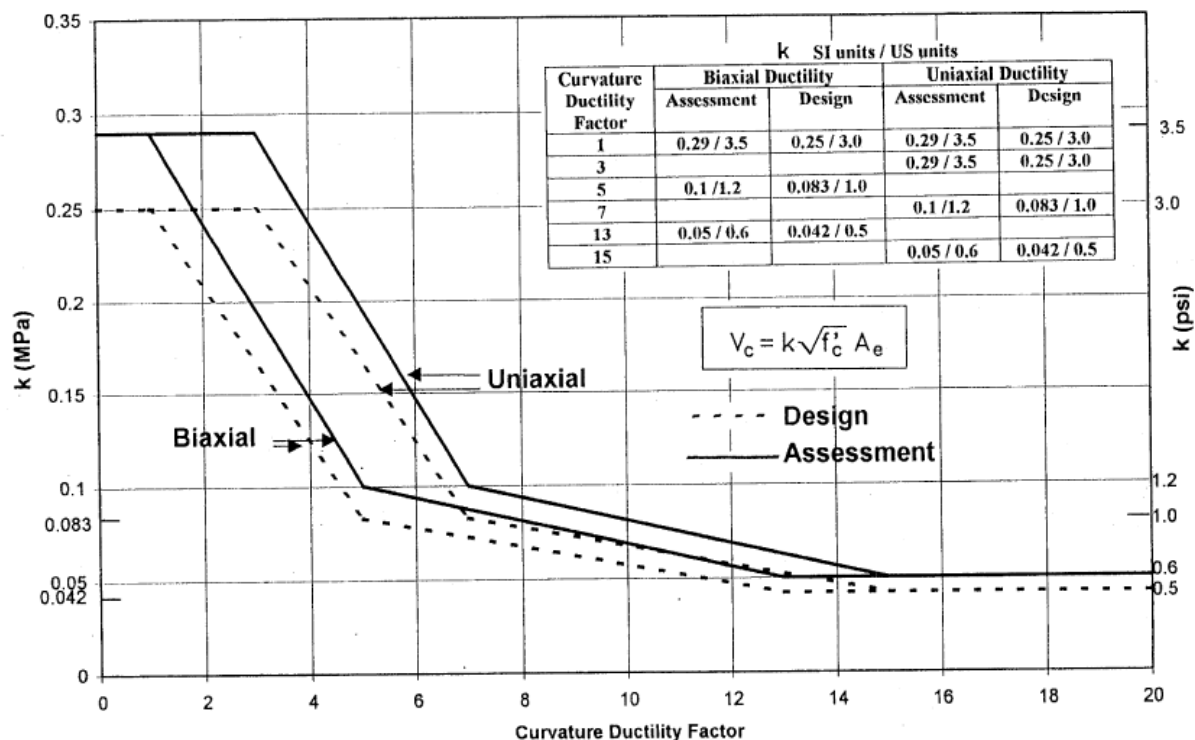


FIGURE 31F-7-6  
CONCRETE SHEAR MECHANISM  
(from Fig. 3-30 of [7.2])

For all nonseismic loading combinations, concrete components shall be designed in accordance with the ACI requirements [7.5].

Note that for existing facilities, the pile/deck hinge may be controlled by the capacity of dowel reinforcement in accordance with Section 317F.2. 7.

**TABLE 31F-7-5  
LIMITS OF STRAIN**

COMPONENT STRAIN	LEVEL 1	LEVEL 2
MCCS Pile/deck hinge	$\epsilon_c \leq 0.004$	$\epsilon_c \leq 0.025$
MCCS In-ground hinge	$\epsilon_c \leq 0.004$	$\epsilon_c \leq 0.008$
MRSTS Pile/deck hinge	$\epsilon_s \leq 0.01$	$\epsilon_s \leq 0.05$
MRSTS In-ground hinge	$\epsilon_s \leq 0.01$	$\epsilon_s \leq 0.025$
MPSTS In-ground hinge	$\epsilon_p \leq 0.005$ (incremental)	$\epsilon_p \leq 0.025$ (total strain)

MCCS = Maximum Concrete Compression Strain,  $\epsilon_c$

MRSTS = Maximum Reinforcing Steel Tension Strain,  $\epsilon_s$

MPSTS = Maximum Prestressing Steel Tension Strain,  $\epsilon_p$

**3107F.2.5.7 Shear design.** If expected lower bound of material strength Section 3107F.2.1.1 Equations (7-2a, 7-2b, 7-2c) are used in obtaining the nominal shear strength, a new nonlinear analysis utilizing the upper bound estimate of material strength Section 3107F.2.1.1 Equations (7-3a, 7-3b, 7-3c) shall be used to obtain the plastic hinge shear demand. An alternative conservative approach is to multiply the maximum shear demand,  $V_{max}$  from the original analysis by 1.4 (Section 8.16.4.4.2 of ATC-32 [7.6]):

$$V_{design} = 1.4V_{max} \quad (7-13)$$

If moment curvature analysis that takes into account strain-hardening, an uncertainty factor of 1.25 may be used:

$$V_{design} = 1.25V_{max} \quad (7-14)$$

Shear capacity shall be based on nominal material strengths, and reduction factors according to ACI-318 [7.5].

As an alternative, the method of Kowalski and Priestley [7.7] may be used. Their method is based on a three-parameter model with separate contributions to shear strength from concrete ( $V_c$ ), transverse reinforcement ( $V_s$ ), and axial load ( $V_p$ ) to obtain nominal shear strength ( $V_n$ ):

$$V_n = V_c + V_s + V_p \quad (7-15)$$

A shear strength reduction factor of 0.85 shall be applied to the nominal strength,  $V_n$  to determine the design shear strength. Therefore:

$$V_{design} \leq 0.85V_n \quad (7-16)$$

The equations to determine  $V_c$ ,  $V_s$  and  $V_p$  are:

$$V_c = k\sqrt{f'_c}A_c \quad (7-17)$$

where:

$k$  = factor dependent on the curvature ductility

$$\mu_\phi = \frac{\phi}{\phi_y}, \text{ within the plastic hinge region, from}$$

Figure 31F-7-6. For regions greater than  $2D_p$  (see Equation 7-18) from the plastic hinge location, the strength can be based on  $\mu_\phi = 1.0$  (see Ferritto et. al. [7.2]).

$f'_c$  = concrete compressive strength

$A_e = 0.8A_g$  is the effective shear area

Circular spirals or hoops [7.2]:

$$V_s = \frac{\frac{\pi}{2} A_{sp} f_{yh} (D_p - c - c_o) \cot(\theta)}{s} \quad (7-18)$$

where:

$A_{sp}$  = spiral or hoop cross section area

$f_{yh}$  = yield strength of transverse or hoop reinforcement

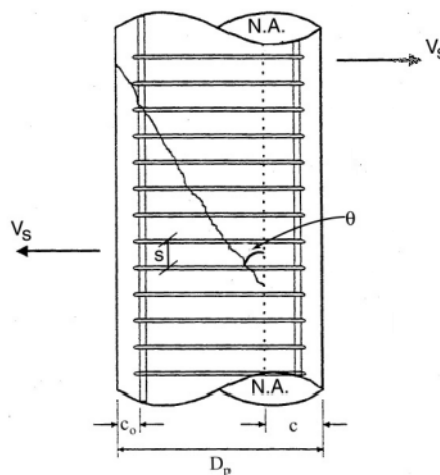
$D_p$  = pile diameter or gross depth (in case of a rectangular pile with spiral confinement)

$c$  = depth from extreme compression fiber to neutral axis (1V.A.) at flexural strength (see Fig. 31F-7-7)

$c_o$  = concrete cover to center of hoop or spiral (see Fig. 31F-7-7)

$\theta$  = angle of critical crack to the pile axis (see Fig. 31F-7-7) taken as  $30^\circ$  for existing structures, and  $35^\circ$  for new design

$s$  = spacing of hoops or spiral along the pile axis



**FIGURE 31F-7-7  
TRANSVERSE SHEAR MECHANISM**

Rectangular hoops or spirals [7.2]:

$$V_s = \frac{A_h f_{yh} (D_p - c - c_o) \cot(\theta)}{s} \quad (7-19)$$

where:

$A_h$  = total area of transverse reinforcement, parallel to direction of applied shear cut by an inclined shear crack

Shear strength from axial mechanism,  $V_p$  (see Fig. 31F-7-8):

$$V_p = \Phi (N_u + F_p) \tan \alpha \quad (7-20)$$

where:

$N_u$  = external axial compression on pile including seismic load. Compression is taken as positive; tension as negative

$F_p$  = prestress compressive force in pile

$\alpha$  = angle between line joining centers of flexural compression in the deck/pile and in-ground hinges, and the pile axis

$\Phi$  = 1.0 for existing structures, and 0.85 for new design

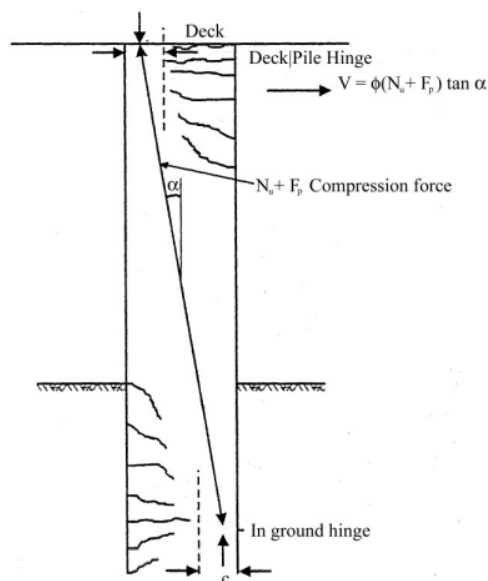


FIGURE 31F-7-8  
AXIAL FORCE SHEAR MECHANISM

### 3107F.2.6 Steel piles.

**3107F.2.6.1 General.** The capacity of steel piles is based on allowable strains corresponding to the desired performance criteria and design earthquake.

**3107F.2.6.2 Stability.** Section 3107F.2.5.2 applies to steel piles.

**3107F.2.6.3 Plastic hinge length.** The plastic hinge length depends on the section shape and the slope of the moment diagram in the vicinity of the plastic hinge.

For plastic hinges forming in steel piles at the deck/pile interface and where the hinge forms in the steel section rather than in a special connection detail (such as a reinforced concrete dowel connection), allowance should be made for strain penetration into the pile cap. This increase

may be taken as  $0.25D_p$ , where  $D_p$  is the pile diameter or pile depth in the direction of the applied shear force.

**3107F.2.6.4 Ultimate flexural strain capacity.** The following limiting value applies:

Strain at extreme-fiber,  $\epsilon_u \leq 0.035$

**3107F.2.6.5 Component acceptance/damage criteria.** The maximum allowable strain may not exceed the ultimate value defined in Section 3107F.2.6.4. Table 31F-7-6 provides limiting strain values for each performance level, for both new and existing structures.

Steel components for noncompact hollow piles ( $D_p/t < 0.07 \times E/f_y$ ) and for all nonseismic loading combinations shall be designed in accordance with AISC [7.8].

TABLE 31F-7-6  
STRUCTURAL STEEL STRAIN LIMITS,  $\epsilon_u$

COMPONENTS	LEVEL 1	LEVEL 2
Concrete Filled Pipe	0.008	0.030
Hollow Pipe	0.008	0.025

Level 1 or 2 refer to the seismic performance criteria (Section 3104F.2.1)

**3107F.2.6.6 Shear design.** The procedures of Section 3107F.2.5.7, which are used to establish  $V_{design}$  are applicable to steel piles.

The shear capacity shall be established from the AISC [7.8]. For concrete filled pipe, equation (7-15) may be used to determine shear capacity; however,  $V_{pile}$  must be substituted for  $V_s$ .

$$V_{pile} = (\pi/2) t f_{y,pile} (D_p - c - c_o) \cot \theta \quad (7-21)$$

where:

$t$  = steel pile wall thickness

$f_{y,pile}$  = yield strength of steel pile

$c_o$  = distance from outside of steel pipe to center of hoop or spiral

[All other terms are as listed for Equation (7-18)].

### 3107F.2.7 Pile/deck connection strength.

**3107F.2.7.1 Joint shear capacity.** The joint shear capacity shall be computed in accordance with ACI 318 [7.5]. For existing MOTs, the method [7.1, 7.2] given below may be used:

1. Determine the nominal shear stress in the joint region corresponding to the pile plastic moment capacity.

$$v_j = \frac{0.9M_p}{\sqrt{2}l_{dv}D_p^2} \quad (7-22)$$

where:

$v_j$  = Nominal shear stress

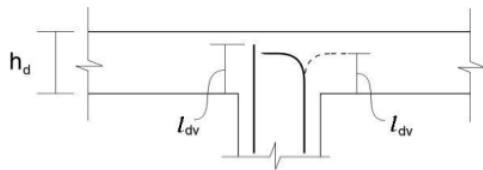
$M_p$  = Over strength moment demand of the plastic hinge (the maximum possible moment in the



pile) as determined from the procedure of Section 3107F.2.5.7.

$l_{dv}$  = Vertical development length, see Figure 31F-7-9

$D_p$  = Diameter of pile



**FIGURE 31F-7-9  
DEVELOPMENT LENGTH**

2. Determine the nominal principal tension  $p_t$ , stress in the joint region:

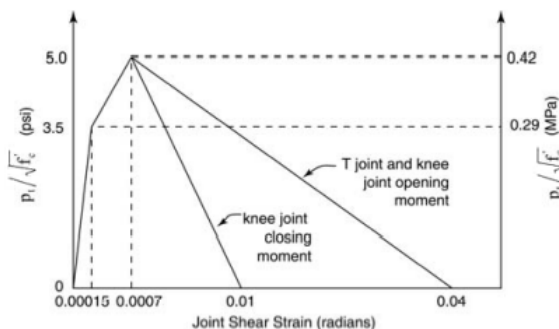
$$p_t = \frac{-f_a}{2} + \sqrt{\left(\frac{f_a}{2}\right)^2 + v_j^2} \quad (7-23)$$

where:

$$f_a = \frac{N}{(D_p + h_d)^2} \quad (7-24)$$

is the average compressive stress at the joint center caused by the pile axial compressive force  $N$  and  $h_d$  is the deck depth. Note, if the pile is subjected to axial tension under seismic load, the value of  $N$ , and  $f_a$  will be negative.

If  $p_t > 5.0 \sqrt{f'_c}$ , psi, joint failure will occur at a lower moment than the column plastic moment capacity  $M_p$ . In this case, the maximum moment that can be developed at the pile/deck interface will be limited by the joint principal tension stress capacity, which will continue to degrade as the joint rotation increases, as shown in Figure 31F-7-10. The moment capacity of the connection at which joint failure initiates can be established from Equations 7-26 and 7-27.



**FIGURE 31F-7-10  
DEGRADATION OF EFFECTIVE  
PRINCIPAL TENSION STRENGTH WITH JOINT  
SHEAR STRAIN (rotation) [7.1, pg. 564]**

For  $p_t = 5.0 \sqrt{f'_c}$ , determine the corresponding joint shear stress,  $v_j$ :

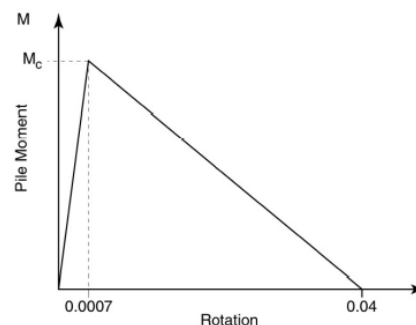
$$v_j = \sqrt{p_t(p_t - f_a)} \quad (7-25)$$

3. The moment capacity of the connection can be approximated as:

$$M_c = \left(\frac{1}{.90}\right) \sqrt{2} v_j l_{dv} D_p^2 \leq M_p \quad (7-26)$$

This will result in a reduced strength and effective stiffness for the pile in a pushover analysis. The maximum displacement capacity of the pile should be based on a drift angle of 0.04 radians.

If no mechanisms are available to provide residual strength, the moment capacity will decrease to zero as the joint shear strain increases to 0.04 radians, as shown in Figure 31F-7-11.



**FIGURE 31F-7-11  
REDUCED PILE MOMENT CAPACITY**

If deck stirrups are present within  $h_d/2$  of the face of the pile, the moment capacity,  $M_{c,r}$ , at the maximum plastic rotation of 0.04 radians may be increased from zero to the following (see Figure 31F-7-12):

$$M_{c,r} = 2A_s f_y (h_d - d_c) + N \left( \frac{D_p}{2} - d_c \right) \quad (7-27)$$

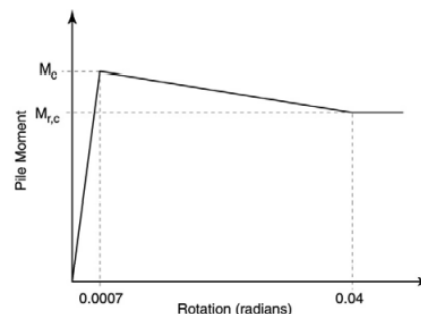
$A_s$  = Area of slab stirrups on one side of joint

$h_d$  = See Figure 31F-7-9 (deck thickness)

$d_c$  = Depth from edge of concrete to center of main reinforcement

In addition, the bottom deck steel ( $A_{s, \text{deckbottom}}$ ) area within  $h_d/2$  of the face of the pile shall satisfy:

$$A_{s, \text{deckbottom}} \geq 0.5 \cdot A_s \quad (7-28)$$



**FIGURE 31F-7-12  
JOINT ROTATION**

4. Using the same initial stiffness as in Section 3107F.2.5.4, the moment-curvature relationship established for the pile top can now be adjusted to account for the joint degradation.

The adjusted yield curvature,  $\phi'_y$ , can be found from:

$$\phi'_y = \frac{\phi_y M_c}{M_n} \quad (7-29)$$

$M_n$  is defined in Figure 31F-7-5.

The plastic curvature,  $\phi_p$ , corresponding to a joint rotation of 0.04 can be calculated as:

$$\phi_p = \frac{0.04}{L_p} \quad (7-30)$$

Where  $L_p$  is given by equation 7-5.

The adjusted ultimate curvature,  $\phi'_u$ , can now be calculated as:

$$\phi'_u = \phi_p + \frac{\phi_y M_{c,r}}{M_n} \quad (7-31)$$

Note that  $M_{c,r} = 0$  unless deck stirrups are present as discussed above. Examples of adjusted moment curvature relationships are shown in Figure 31F-7-13.

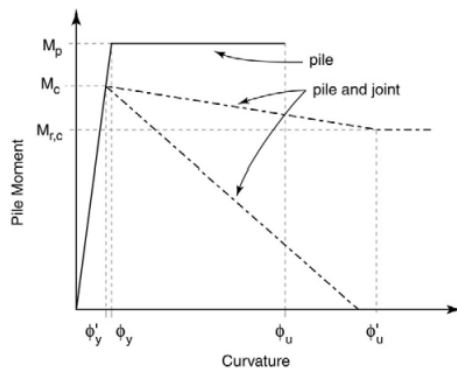


FIGURE 31F-7-13  
EQUIVALENT PILE CURVATURE

**3107F.2.7.2 Development Length.** The development length,  $l_{dc}$ , is:

$$l_{dc} \geq \frac{0.025 \cdot d_b \cdot f_{ye}}{\sqrt{f'_c}} \quad (7-32)$$

where:

$d_b$  = dowel bar diameter

$f_{ye}$  = expected yield strength of dowel

$f'_c$  = compressive strength of concrete

In assessing existing details, actual or estimated values for  $f_{ye}$  and  $f'_c$  rather than nominal strength should be used in accordance with Section 3107F.2.1.1.

When the development length is less than that calculated by the equation 7-32, the moment capacity shall be calculated using a proportionately reduced yield strength,  $f_{ye,r}$ , for the vertical pile reinforcement:

$$f_{ye,r} = f_{ye} \cdot \frac{l_d}{l_{dc}} \quad (7-33)$$

where:

$l_d$  = actual development length

$f_{ye}$  = expected yield strength of dowel

### 3107F.2.8 Batter piles.

**3107F.2.8.1 Existing ordinary batter piles.** Wharves or piers with ordinary (not fused, plugged or having a seismic release mechanism) batter piles typically have a very stiff response when subjected to lateral loads in the direction of the batter. The structure often maintains most of its initial stiffness all the way to failure of the first row of batter piles. Since batter piles most likely will fail under a Level 2 seismic event, the following method may be used to evaluate the post-failure behavior of the wharf or pier:

1. Identify the failure mechanism of the batter pile-deck connection (refer to Section 3104F.4. 7) for typical failure scenarios) and the corresponding lateral displacement.
2. Release the lateral load between the batter pile and the deck when the lateral failure displacement is reached.
3. Push on the structure until subsequent failure(s) have been identified.

As an example, following these steps will result in a force-displacement (pushover) curve similar to the one shown in Figure 31F-7-14 for a wharf supported by one row of batter piles.

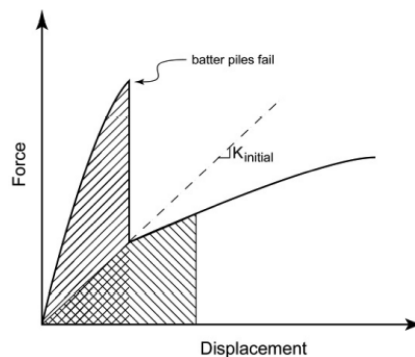


FIGURE 31F-7-14  
PUSHOVER CURVE FOR ORDINARY BATTER PILES

When the row of batter piles fail in tension or shear, stored energy will be released. The structure will therefore experience a lateral displacement demand following the nonductile pile failures. If the structure can respond to this displacement demand without exceeding other structural limita-

tions, it may be assumed that the structure is stable and will start to respond to further shaking with a much longer period and corresponding lower seismic demands. The wharf structure may therefore be able to sustain larger seismic demands following the loss of the batter piles than before the loss of pile capacity, because of a much softer seismic response.

The area under the pushover curve before the batter pile failures is compared to the equivalent area under the post failure pushover curve (refer to Figure 31F-7-14). If no other structural limitations are reached with the new displacement demand, it is assumed that the structure is capable of absorbing the energy. It should be noted that even though the shear failure is nonductile, it is expected that energy will be absorbed and the damping will increase during the damage of the piles. The above method is, therefore, considered conservative.

Following the shear failure of a batter pile row, the period of the structure increases such that equal displacement can be assumed when estimating the post-failure displacement demand. The new period may be estimated from the initial stiffness of the post-failure system as shown in Figure 31F-7-14. A new displacement demand can then be calculated in accordance with Section 3104F.2.

**3107F.2.8.2 Nonordinary Batter Piles.** For the case of a plugged batter pile system, an appropriate displacement force relationship considering plug friction may be used in modeling the structural system.

For fused and seismic release mechanism batter pile systems, a nonlinear modeling procedure shall be used and peer reviewed (Section 3101F.6.1).

**3107F.2.9 Concrete pile caps with concrete deck.** Pile caps and decks are capacity protected components. Use the procedure of Section 3107F.2.5.7 to establish the over strength demand of the plastic hinges. Component capacity shall be based on nominal material strengths, and reduction factors according to ACI-318 [7.5].

**3107F.2.9.1 Component acceptance/damage criteria.** For new pile caps and deck, Level 1 seismic performance shall utilize the design methods in ACI-318 [7.5]; Level 2 seismic performance shall be limited to the following strains:

Deck/pile cap:  $\epsilon_c \leq 0.005$

Reinforcing steel tension strain:  $\epsilon_s \leq 0.01$

For existing pile caps and deck, the limiting strain values are defined in Table 31F-7-5.

Concrete components for all nonseismic loading combinations shall be designed in accordance with ACI 318 [7.5].

**3107F.2.9.2 Shear capacity (strength).** Shear capacity shall be based on nominal material strengths; reduction factors shall be in accordance with ACI318 [7.5].

**3107F.2.10 Concrete detailing.** For new MOTs, the required development splice length, cover and detailing shall conform to ACI 318 [7.5], with the following exceptions:

1. For pile/deck dowels, the development length may be calculated in accordance with Section 3107F.2.7.2.
2. The minimum concrete cover for prestressed concrete piles shall be three inches, unless corrosion inhibitors are used, in which case a cover of two-and-one-half inches is acceptable.
3. The minimum concrete cover for wharf beams and slabs, and all concrete placed against soil shall be three inches, except for headed reinforcing bars (pile dowels or shear stirrups) the cover may be reduced to two-and-one-half inch cover at the top surface only. If corrosion inhibitors are used, a cover of two-and-one-half inches is acceptable.

### 3107F.3 Timber piles and deck components.

**3107F.3.1 Component strength.** The following parameters shall be established in order to assess component strength:

New and existing components:

1. Modulus of rupture
2. Modulus of elasticity
3. Type and grade of timber

Existing components only:

1. Original cross-section shape and physical dimensions
2. Location and dimension of braced frames
3. Current physical condition of members including visible deformation
4. Degradation may include environmental effects (e.g., decay, splitting, fire damage, biological and chemical attack) including its effect on the moment of inertia,  $I$
5. Loading and displacement effects (e.g., overload, damage from earthquakes, crushing and twisting)

Section 3104F.2.2 discusses existing material properties. At a minimum, the type and grade of wood shall be established. The adjusted design stress values in the ANSI/AF&PA NDS [7.9] may be used as default values by replacing the Format Conversion Factor of ANSI/AF&PA NDS [7.9] with the factor 2.8 divided by the Resistance Factor (Table N1 [7.9]).

For deck components, the adjusted design stresses shall be limited to the values of ANSI/AF&PA NDS [7.9]. Piling deformation limits shall be calculated based on the strain limits in accordance with Section 3107F.3.3.3.

The values shown in the ANSI/AF&PA NDS [7.9] are not developed specifically for MOTs and can be used as default properties only if as-built information is not available, the member is not

damaged and testing is not performed. To account for the inherent uncertainty in establishing component capacities for existing structures with limited knowledge about the actual material properties, a reduction (knowledge) factor of  $k = 0.75$  shall be included in the component strength and deformation capacity analyses in accordance with Section 3107F.2.1.2.

The modulus of elasticity shall be based on tests or the ANSI/AF&PA NDS Tables 6A and 6B [7.9]. Alternatively the values shown in Table 31F-7-7 may be used for typical timber piles.

**TABLE 31F-7-7 [after (7.9)]  
MODULUS OF ELASTICITY (E) FOR TYPICAL TIMBER PILES**

SPECIES	E (psi)
Pacific Coast Douglas Fir	1,500,000
Red Oak	1,250,000
Red Pine	1,280,000
Southern Pine	1,500,000

**3107F.3.2 Deformation capacity of flexural members.** The displacement demand and capacity of existing timber structures may be established per Section 3104F.2.

The soil spring requirements for the lateral pile analysis shall be in accordance with Section 3106F.

A linear curvature distribution may be assumed along the full length of a timber pile.

The displacement capacity of a timber pile can then be established per Section 3107F.3.3.2.

### 3107F.3.3 Timber piles.

**3107F.3.3.1 Stability.** Section 3107F.2.5.2 shall apply to timber piles.

**3107F.3.3.2 Displacement capacity.** A distinction shall be made between a pier-type pile, with a long unsupported length and a wharf-landside-type pile with a short unsupported length between the deck and soil. The effective length,  $L$ , is the distance between the pinned deck/pile connection and in-ground fixity as shown in Figure 31F-7-15. For pier-type (long unsupported length) vertical piles, three simplified procedures to determine fixity or displacement capacity are described in UFC 4-151-10 [7.10], UFC 3-220-01A [7.11] and Chai [7.12].

In order to determine fixity in soft soils, another alternative is to use Table 31F-7-8.

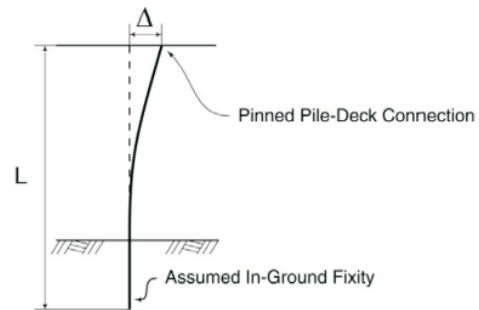
The displacement capacity,  $\Delta$ , for a pile pinned at the top, with effective length,  $L$ , (see Table 31F-7-8 and UFC 4-151-10[7.10]), and moment,  $M$ , is:

$$\Delta = \frac{ML^2}{3EI} \quad (7-34)$$

where:

$E$  = Modulus of elasticity

$I$  = Moment of inertia



**FIGURE 31F-7-15  
ASSUMED IN-GROUND FIXITY**

Assuming linear curvature distribution along the pile, the allowable curvature,  $\phi_a$ , can be established from:

$$\phi_a = \frac{\epsilon_a}{c_u} \quad (7-35)$$

where:

$\epsilon_a$  = allowable strain limit according to Section 3107F.3.3.3

$c_u$  = distance to neutral axis which can be taken as  $D_p/2$ , where  $D_p$  is the diameter of the pile

The curvature is defined as:

$$\phi = \frac{M}{EI} \quad (7-36)$$

The maximum allowable moment therefore becomes:

$$M = \frac{2\epsilon_a}{D_p} EI \quad (7-37)$$

The displacement capacity is therefore given by:

$$\Delta = \frac{2\epsilon_a L^2}{3D_p} \quad (7-38)$$

**TABLE 31F-7-8  
DISTANCE BELOW GROUND TO POINT OF FIXITY**

PILE $EI_g$	SOFT CLAYS	LOOSE GRANULAR & MEDIUM CLAYS
$< 10^{10}$ lb in <sup>2</sup>	10 feet	8 feet
$> 10^{10}$ lb in <sup>2</sup>	12 feet	10 feet

**3107F.3.3.3 Component acceptance/damage criteria.** The following limiting strain values apply for each seismic performance level for existing structures:

**TABLE 31F-7-9  
LIMITING STRAIN VALUES FOR TIMBER**

EARTHQUAKE LEVEL	MAX. TIMBER STRAIN
Level 1	0.002
Level 2	0.004

For new and alternatively, for existing structures ANSI/AF&PA NDS [7.9] may be used.

Timber components for all nonseismic loading combinations shall be designed in accordance with ANSI/AF&PA NDS [7.9].



**3107F.3.3.4 Shear design.** To account for material strength uncertainties, the maximum shear demand,  $V_{max}$ , established from the single pile lateral analysis shall be multiplied by 1.2:

$$V_{demand} = 1.2V_{max} \quad (7-39)$$

The factored maximum shear stress demand  $\tau_{max}$ , in a circular pile can then be determined:

$$\tau_{max} = \frac{10}{9} \frac{V_{demand}}{\pi \cdot r^2} \quad (7-40)$$

where:

$r$  = radius of pile

For the seismic load combinations, the maximum allowable shear stress,  $\tau_{capacity}$ , is the design shear strength,  $\tau_{design}$ , from the ANSI/AF&PA NDS [7.9] multiplied by a factor of 2.8.

$$\tau_{capacity} = 2.8\tau_{design} \quad (7-41)$$

The shear capacity must be greater than the maximum demand.

**3107F.4 Retaining structures.** Retaining structures constructed of steel or concrete shall conform to AISC [7.8] or ACI 318 [7.5] respectively. For the determination of static and seismic loads on the sheet pile and sheet pile behavior, the following references are acceptable: NCEL [7.13], Strom and Ebeling [7.14], and PIANC TC-7(Technical Commentary - 7) [7.15]. The applied loads and analysis methodology shall be determined by a California registered geotechnical engineer, and may be subject to peer review.

**3107F.5 Mooring and berthing components.** Mooring components include bitts, bollards, cleats, pelican hooks, capstans, mooring dolphins and quick release hooks.

Berthing components include fender piles and fenders, which may be camels, fender panels or wales.

Applicable safety factors to be applied to the demand are provided in Section 3103F.10.

**3107F.5.1 Component strength.** The following parameters shall be established in order to calculate component strength:

New and existing components:

1. Yield and tensile strength of structural steel
2. Structural steel modulus of elasticity
3. Yield and tensile strength of bolts
4. Concrete infill compressive strength
5. Concrete infill modulus of elasticity

Additional parameters for existing components:

1. Condition of steel including corrosion
2. Effective cross-sectional areas
3. Condition of embedment material such as concrete slab or timber deck

**3107F.5.2 Mooring and berthing component demand.** The maximum mooring line forces (demand) shall be estab-

lished per Section 3105F. Multiple lines may be attached to the mooring component at varying horizontal and vertical angles. Mooring components shall therefore be checked for all the mooring analysis load cases. The maximum demand on breasting dolphins and fender piles shall be established according to Sections 3103F.6 and 3105F.

**3107F.5.3 Capacity of mooring and berthing components.** The structural and connection capacity of mooring components bolted to the deck shall be established in accordance with AISC [7.8], ACI-318 [7.5], ANSI/AF&PA NDS [7.9] as appropriate. The mooring component capacity may be governed by the strength of the deck material. Therefore, a check of the deck capacity to withstand mooring component loads shall be performed.

### 3107F.6 Symbols.

$A_e$  = Effective shear area

$A_g$  = Uncracked, gross section area

$A_h$  = Total area of transverse reinforcement, parallel to direction of applied shear cut by an inclined shear crack

$A_s$  = Area of reinforcing steel

$A_{sp}$  = Spiral or hoop cross section area

$c$  = Depth from extreme compression fiber to neutral axis at flexural strength

$c_o$  = Outside of steel pipe to center of hoop or spiral or concrete cover to center of hoop or spiral

$c_u$  = Value of neutral axis depth at ultimate strength of section

$D$  = Pile diameter

$D^*$  = Reference diameter of 6 ft

$d_b$  = Dowel bar diameter

$d_c$  = Depth from edge of concrete to center of reinforcement

$d_{bl}$  = Diameter of the longitudinal reinforcement

$D_c$  = Depth of pile cap

$D_p$  = Pile diameter or gross depth (in case of a rectangular pile with spiral confinement)

$e$  = Eccentricity of axial load

$\epsilon_a$  = Allowable strain limit

$\epsilon_{cm}$  = Max extreme fiber compression strain

$\epsilon_{acu}$  = Ultimate concrete compressive strain

$\epsilon_{sm}$  = Strain at peak stress of confining reinforcement

$\epsilon_u$  = Ultimate steel strain

$E$  = Modulus of elasticity

$f'_c$  = Concrete compression strength

$f'_{cc}$  = Confined strength of concrete

$F_p$  = Prestress compression force in pile

$f_p$  = Yield strength of prestress strands

$f_y$  = Yield strength of steel

$f_{ye}$  = Design yield strength of longitudinal or dowel reinforcement (ksi)  
 $f_{yh}$  = Yield stress of confining steel  
 $f_{yh}$  = Yield strength of transverse or hoop reinforcement  
 $f_{y,pile}$  = Yield strength of steel pile  
 $f_{ye,r}$  = Reduced dowel yield strength  
 $h$  = Width of pile in considered direction  
 $h_d$  = Deck depth  
 $H$  = Distance from ground to pile point of contraflexure  
 $I_c$  = Moment of inertia of uncracked section  
 $I_e$  = Effective moment of inertia  
 $I_g$  = Gross moment of inertia  
 $K$  = Subgrade modulus  
 $k$  = Factor dependent on the curvature ductility  $\mu_\phi = \Phi/\Phi_y$ , within the plastic hinge region  
 $k$  = Knowledge factor  
 $L$  = The distance from the critical section of the plastic hinge to the point of contraflexure  
 $L_p$  = Plastic hinge length  
 $l_{dc}$  = Minimum development length  
 $l_d$  = Existing development length  
 $l_{dv}$  = Vertical development length  
 $M_c$  = Moment capacity of the connection  
 $M_{c,r}$  = Moment capacity at plastic rotation  
 $M_n$  = Moment at secant stiffness  
 $M_p$  = Moment as determined from a pushover analysis at displacements corresponding to the damage control limit state  
 $M_y$  = Moment at first yield  
 $N$  = Pile axial compressive force  
 $N_u$  = External axial compression on pile including load due to earthquake action  
 $\rho_s$  = Effective volume ratio of confining steel  
 $\rho_t$  = Nominal principal tension  
 $r$  = Radius of circular pile  
 $s$  = Spacing of hoops or spiral along the pile axis  
 $t$  = Pile wall thickness  
 $\Delta$  = Displacement  
 $\Phi$  = 1.0 for existing structures, and 0.85 for new design  
 $\theta$  = Angle of critical crack to the pile axis (taken as  $30^\circ$  for existing structures, and  $35^\circ$  for new design)  
 $\theta_p$  = Plastic rotation  
 $\alpha$  = Angle between line joining centers of flexural compression in the deck/pile and in-ground hinges, and the pile axis  
 $\phi_a$  = Allowable curvature

$\phi_m$  = Maximum curvature  
 $\phi_p$  = Plastic curvature  
 $\phi_u$  = Ultimate curvature  
 $\phi'_u$  = Adjusted ultimate curvature  
 $\phi_y$  = Yield curvature  
 $\phi'_y$  = Adjusted yield curvature  
 $\tau_{max}$  = Maximum shear stress  
 $V_c$  = Concrete shear strength  
 $v_j$  = Joint shear stress  
 $V_{design}$  = Design shear strength  
 $V_{max}$  = Maximum shear demand  
 $V_n$  = Nominal shear strength  
 $V_s$  = Transverse reinforcement shear capacity (strength)  
 $V_{pile}$  = Shear strength of steel pile

### 3107F.6 References.

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- [7.5] American Concrete Institute, ACI 318-05, 2005, "Building Code Requirements for Structural Concrete (318-05) and Commentary (318R-05)," Farmington Hills, Michigan.
- [7.6] Applied Technology Council, 1996, ATC-32, "Improved Seismic Design Criteria for California Bridges: Provisional Recommendations," Redwood City, CA.
- [7.7] Kowalski, M.J. and Priestley, M.J.N., "Shear Strength of Ductile Bridge Columns," Proc. 5th Caltrans Seismic Design Workshop, Sacramento, June 1998.
- [7.8] American Institute of Steel Construction (AISC), 2005, "Steel Construction Manual," Thirteenth Edition, Chicago, IL.

- [7.9] *American Forest & Paper Association, 2005, "National Design Specification for Wood Construction," ANSI/AF&PA NDS-2005, Washington, D.C.*
- [7.10] *Department of Defense, 10 September 2001, Unified Facilities Criteria (UFC) 4-151-10, "General Criteria for Waterfront Construction, Washington, D.C.*
- [7.11] *Department of Defense, 16 January 2004, Unified Facilities Criteria (UFC) 3-220-01A, "Deep Foundations," Washington, D.C.*
- [7.12] *Chai, Y.H., "Flexural Strength and Ductility of Extended Pile-Shafts, I: Analytical Model", Journal of Structural Engineering, May 2002, pp. 586–594.*
- [7.13] *Ebeling, Robert M. and Morrison, Ernest E., Jr., "The Seismic Design of Waterfront Retaining Structures", U.S. Army Technical Report ITL-92-11/U.S. Navy Technical Report NCEL TR 939, Dept. of Army, Corps of Engineers, Waterways Experiment Station, Vicksburg, MS, November 1992.*
- [7.14] *Strom, Ralph W. and Robert M. Ebeling, "State of the Practice in the Design of Tall, Stiff, and Flexible Tieback Retaining Walls", Information Technology Laboratory, Engineer Research and Development Center, U.S. Army Corps of Engineers, Vicksburg, MS, December 2001.*
- [7.15] *Permanent International Association of Navigation Congresses (PIANC), "Seismic Design Guidelines for Port Structures," Technical Commentary-7, Working Group No. 34 of the Maritime Navigation Commission International Navigation Association, A.A. Balkema, Lisse, Netherlands. 2001.*

*Authority: Sections 8755 and 8757, Public Resources Code.*

*Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

## Division 8

### SECTION 3108F FIRE PREVENTION, DETECTION AND SUPPRESSION

**3108F.1 General.** This section provides minimum standards for fire prevention, detection and suppression at MOTs. See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

#### **3108F.2 Hazard assessment and risk analysis.**

**3108F.2.1 Fire hazard assessment and risk analysis (N/E).** A fire hazard assessment and risk analysis shall be performed, considering the loss of commercial power, earthquake and other relevant events.

**3108F.2.2 Fire Protection Assessment (N/E).** A site-specific Fire Protection Assessment shall be prepared by a registered engineer or a competent fire protection professional. The assessment shall consider the hazards and risks identified per Section 3108F.2.1 and shall include, but not be limited to, the elements of prefire planning as discussed in Section 9 of [8.1] and Chapter 3 of [8.2]. The Fire Protection Assessment shall include goals, resources, organization, strategy and tactics, including the following:

1. MOT characteristics (e.g., tanker/manifold, product pipelines, etc.)
2. Product types and fire scenarios
3. Possible collateral fire damage to adjacent facilities
4. Fire-fighting capabilities, including availability of water (flow rates and pressure), foam type and associated shelf life, proportioning equipment, and vehicular access [8.1, 8.3]
5. The selection of appropriate extinguishing agents [8.1, 8.2]
6. Calculation of water and foam capacities, as applicable, consistent with area coverage requirements [8.1]
7. Coordination of emergency efforts
8. Emergency escape routes [8.2, 8.3]
9. Requirements for fire drills, training of personnel, and the use of equipment
10. Life safety
11. Rescue for terminal and vessel personnel [8.1]
12. Cooling water for pipelines and valves exposed to the heat
13. Contingency planning when supplemental fire support is not available. Mutual aid agreements can apply to water and land based support
14. Consideration of adverse conditions, such as electrical power failure, steam failure, fire pump failure, an earthquake or other damage to the fire water system.

The audit team shall review and field verify the fire-fighting equipment locations and condition and may check its operability.

**3108F.2.3 Cargo liquid and fire hazard classifications (N/E).** The cargo liquid hazard classes are defined in Table 31F-8-1, as either High ( $H_C$ ) or Low ( $L_C$ ), depending on the flash point.

Fire hazard classifications (Low, Medium or High) are defined in Table 31F-8-2, and are based on the cargo liquid hazard class and the sum of all stored and flowing volumes, prior to the emergency shut down system (ESD) stopping the flow of oil.

The stored volume is the sum of the  $H_C$  and  $L_C$  liquid hazard class piping volumes ( $V_{SH}$  and  $V_{SL}$ ), if the piping is not stripped.

During a pipeline leak, a quantity of oil is assumed to spill at the maximum cargo flow rate until the ESD is fully effective. The ESD valve closure is required to be completed in 60 seconds if installed prior to November 1, 1980 or in 30 seconds if installed after that date (2 CCR 2380 (h) (3)) [8.3]. The flowing volume is the sum of the  $H_C$  and  $L_C$  liquid hazard class volumes ( $V_{FH}$  and  $V_{FL}$ ), and shall be calculated as follows:

$$V_F = Q_C \times \Delta t \times (1 / 3,600) \quad (8-1)$$

where:

$V_F$  = Flowing Volume ( $V_{FH}$  or  $V_{FL}$ ) [bbl]

$Q_C$  = Cargo Transfer Rate [bbl/hr]

$\Delta t$  = ESD time, 30 or 60 seconds

#### **3108F.3 Fire prevention.**

##### **3108F.3.1 Ignition source control.**

**3108F.3.1.1 Protection from ignition by static electricity,** lightning or stray currents shall be in accordance with API RP 2003 [8.5] (N/E).

**3108F.3.1.2 Requirements to prevent electrical arcing** shall be in conformity with 2 CCR 2341 [8.3] (N/E).

**3108F.3.1.3 Multiberth terminal piers** shall be constructed so as to provide a minimum of 100 ft between adjacent manifolds (N).

**3108F.3.2 Emergency shutdown systems.** An essential measure of fire prevention is communications in conjunction with the emergency shutdown. The ESD and isolation system shall conform to 2 CCR 2380 (h) [8.3] and 33 CFR 154.550 [8.6]. An ESD system shall include or provide:

1. An ESD valve, located near the dock manifold connection or loading arm (N/E).
2. ESD valves, with “Local” and “Remote” actuation capabilities (N).
3. Remote actuation stations strategically located, so that ESD valve(s) may be shut within required times (N).



**TABLE 31F-8-1  
CARGO LIQUID HAZARD CLASS**

CLASS	CRITERION	REFERENCE	EXAMPLES
Low ( $L_C$ )	Flash Point $\geq 140^\circ\text{F}$	ISGOTT (Chapter 1, [8.4]) —Nonvolatile	#6 Heavy Fuel Oil, residuals, hunker
High ( $H_C$ )	Flash Point $< 140^\circ\text{F}$	ISGOTT (Chapter 1, [8.4]) —Volatile	Gasoline, JP4, crude oils

**TABLE 31F-8-2  
FIRE HAZARD CLASSIFICATIONS**

CLASS	STORED VOLUME (bbl)			FLOWING VOLUME (bbl)		CRITERIA (bbls)*
	Stripped	$V_{SL}$	$V_{SH}$	$V_{FL}$	$V_{FH}$	
LOW	y	n	n	y	y	$V_{FL} \geq V_{FH}$ , and $V_T \leq 1200$
LOW	n	y	n	y	n	$V_{SL} + V_{FL} \leq 1200$
MEDIUM	n	n	y	n	y	$V_{SH} + V_{FH} \leq 1200$
MEDIUM	y	n	n	y	y	$V_{FH} > V_{FL}$ , and $V_T \leq 1200$
HIGH	y	n	n	y	y	$V_T > 1200$
HIGH	n	y	y	y	y	$V_T > 1200$
HIGH	n	y	n	y	n	$V_{SL} + V_{FL} > 1200$
HIGH	n	n	y	n	y	$V_{SH} + V_{FH} > 1200$

y = yes

n = no

Stripped = product purged from pipeline following product transfer event.

 $V_{SL}$  = stored volume of low-hazard class product $V_{SH}$  = stored volume of high-hazard class product $V_{FL}$  = volume of low-hazard class product flowing through transfer line during 30 - 60 secs. ESD. $V_{FH}$  = volume of high-hazard class product flowing through transfer line during 30 - 60 secs. ESD. $V_T = V_{SL} + V_{SH} + V_{FL} + V_{FH}$  = Total Volume (stored and flowing)

\* Quantities are based on maximum flow rate, including simultaneous transfers.

4. Multiple actuation stations installed at strategic locations, so that one such station is located more than 100 ft from areas classified as Class I, Group D, Division 1 or 2 [8.7]. Actuation stations shall be wired in parallel to achieve redundancy and arranged so that fire damage to one station will not disable the ESD system (N).
5. Communications or control circuits to synchronize simultaneous closure of the shore isolation valves (SIVs) with the shut down of loading pumps (N).
6. A manual reset to restore the ESD system to an operational state after each initiation (N).
7. An alarm to indicate failure of the primary power source (N).
8. A secondary (emergency) power source (N).
9. Periodic testing of the system (N/E).
10. Fire proofing of motors and control-cables that are installed in areas classified as Class I, Group D, Division 1 or 2 [8.7]. Fire proofing shall, at a minimum, comply with the recommendations of API Publication 2218 (see Section 6 of [8.8]) (N).
2. Be clearly identified together with associated pipeline (N/E).
3. Have adequate lighting (N/E).
4. Be provided with communications or control circuits to synchronize simultaneous closure of the ESD system with the shut down of loading pumps (N).
5. Have a manual reset to restore the SIV system to an operational state after each shut down event (N).
6. Be provided with thermal expansion relief to accommodate expansion of the liquid when closed. Thermal relief piping shall be properly sized and routed around the SIV, into the downstream segment of the pipeline or into other containment (N/E).

SIVs installed in pipelines carrying hazard class, HC liquids, or at a MOT with a risk classification "Medium" or "High" (see Table 31F-4-1), shall be equipped with "Local" and "Remote" actuation capabilities. Local control SIVs may be motorized and/or operated manually (N).

**3108F.4 Fire detection.** An MOT shall have a permanently installed automated fire detection or sensing system (N).

Fire detection systems shall be tested and maintained per the manufacturer or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

**3108F.3.3 Shore Isolation Valves (SIV).** Shore isolation valve(s) shall:

1. Be located onshore for each cargo pipeline. All SIVs shall be clustered together, for easy access (N).

**3108F.5 Fire alarms.** Automatic and manual fire alarms shall be provided at strategic locations. The fire alarm system shall be arranged to provide a visual and audible alarm that can be readily discerned by all personnel at the MOT. Additionally, visual and audible alarms shall be displayed at the Facility's Control Center (N/E).

If the fire alarm system is integrated with the ESD system, the operation shall be coordinated with the closure of SIVs, block valves and pumps to avoid adverse hydraulic conditions (N/E).

Fire alarms shall be tested and maintained in accordance with NFPA-72 [8.9] or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

**3108F.6 Fire suppression.** Table 31F-8-3 gives the minimum provisions for fire-water flow rates and fire extinguishers. The table includes consideration of the fire hazard classification (Low, Medium or High), the cargo liquid hazard class (Low or High) and the vessel or barge size. The minimum provisions may have to be augmented for multi-berth terminals or those conducting simultaneous transfers, in accordance with the risks identified in the Fire Protection Assessment.

**3108F.6.1 Coverage (N/E).** The fire suppression system shall provide coverage for:

1. Marine structures including the pier/wharf and approach trestle
2. Terminal cargo manifold
3. Cargo transfer system including loading arms, hoses and hose racks
4. Vessel manifold
5. Sumps

## 6. Pipelines

### 7. Control stations

**3108F.6.2 Fire hydrants.** Hydrants shall be located not greater than 150 ft apart, along the wharf and not more than 300 ft apart on the approach trestle [8.4] (N). Additional hose connections shall be provided at the base of fixed monitors and upstream of the water and foam isolation valves. Connections shall be accessible to fire trucks or mutual aid equipment as identified in the Fire Protection Assessment (N/E).

Hydrants and hoses shall be capable of applying two independent water streams covering the cargo manifold, transfer system, sumps and vessel manifold (N/E).

**3108F.6.3 Fire water.** The source of fire water shall be reliable and provide sufficient capacity as determined in the Fire Protection Assessment. Water-based fire protection systems shall be tested and maintained per NFPA 25 [8.10], as adopted and amended by the State Fire Marshal, or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

1. All wet systems shall be kept pressurized (jockey pump or other means) (N/E).
2. Wet system headers shall be equipped with a low-pressure alarm wired to the control room (N).
3. Fire pumps shall be installed at a distance of at least 100 ft from the nearest cargo manifold area (N).
4. Hose connections for fireboats or tugboats shall be provided on the MOT fire water line, and at least one connection shall be an international shore fire connection at each berth [8.4]. Connections shall be installed at a safe access distance from the high-risk

**TABLE 31F-8-3  
MINIMUM FIRE SUPPRESSION PROVISIONS (N/E)**

FIRE HAZARD CLASSIFICATION (From Table 31F-8-2)	VESSEL AND CARGO LIQUID HAZARD CLASS (From Table 31F-8-1)	MINIMUM PROVISIONS
LOW	Barge with $L_C$ (including drums)	<b>500 gpm of water</b> 2 x 20 lb portable dry chemical and 2 x 110 lb wheeled dry chemical extinguishers or the equivalent.
	Barge with $H_C$ (including drums) Tankers < 50 KDWT, handling $L_C$ or $H_C$	<b>1,500 gpm of water</b> 2 x 20 lb portable dry chemical and 2 x 165 lb wheeled dry chemical extinguishers or the equivalent
MEDIUM	Tankers < 50 KDWT handling $L_C$	<b>1,500 gpm of water</b> 2 x 20 lb portable dry chemical and 2 x 165 lb wheeled dry chemical extinguishers or the equivalent.
	Tankers < 50 KDWT, handling $H_C$	<b>2,000 gpm of water</b> 4 x 20 lb portable dry chemical and 2 x 165 lb wheeled dry chemical extinguishers or the equivalent.
HIGH	Tankers < 50 KDWT, handling $L_C$ or $H_C$	<b>3,000 gpm of water</b> 4 x 20 lb portable dry chemical and 2 x 165 lb wheeled dry chemical extinguishers or the equivalent.
LOW, MEDIUM, HIGH	Tankers > 50 KDWT, handling $L_C$ or $H_C$	<b>3,000 gpm of water</b> 6 x 20 lb portable dry chemical and 4 x 165 lb wheeled dry chemical extinguishers or the equivalent.

Notes:  $L_C$  and  $H_C$  are defined in Table 31F-8-1. KDWT = Dead Weight Tons (Thousands)

areas such as sumps, manifolds and loading arms (N/E).

**3108F.6.4 Foam supply (N/E).** Product flammability, foam type, water flow rates and application duration shall be considered in foam supply calculations.

Fixed foam proportioning equipment shall be located at a distance of at least 100 ft from the high-risk areas such as sump, manifold and loading arms, except where hydraulic limits of the foam delivery system require closer proximity.

MOTs shall have a program to ensure that foam is replaced according to the manufacturer's recommendations.

**3108F.6.5 Fire monitor systems.** Fire monitors shall be located to provide coverage of MOT cargo manifolds, loading arms, hoses, and vessel manifold areas. This coverage shall provide at least two independent streams of water/foam. Monitors shall be located to provide an unobstructed path between the monitor and the target area (N/E).

If the vessel manifold is more than 30 ft above the wharf deck, the following factors shall be considered, in order to determine if monitors located on elevated masts or towers are required (N/E):

1. Maximum tanker freeboard
2. Tidal variations
3. Pier/wharf/loading platform elevation
4. Winds
5. Fire water line pressure

Sprinklers and/or remotely controlled water/foam monitors shall be installed to protect personnel, escape routes, shelter locations and the fire water system (N).

Isolation valves shall be installed in the fire water and the foam lines in order to segregate damaged sections without disabling the entire system. Readily accessible isolation valves shall be installed 100–150 ft from the manifold and the loading arm/hose area (N).

**3108F.6.6 Supplemental fire suppression systems (E).** A supplemental system is an external waterborne or land-based source providing suppressant and equipment. Supplemental systems may not provide more than one-quarter of the total water requirements specified in the Fire Protection Assessment.

Additionally, supplementary systems shall not be considered in a Fire Protection Assessment, unless available within 20 minutes following the initiation of a fire alarm. Mutual aid may be considered as part of the supplemental system.

**3108F.7 Critical systems seismic assessment (N/E).** Fire detection and protection systems, and emergency shutdown systems shall have a seismic assessment per Section 3104F.5.3. For equipment anchorages and supports, see Section 3110F.8.

#### 3108F.8 References.

[8.1] American Petroleum Institute, 1998, *API Recommended Practice 2001 (APIRP 2001)*, "Fire Protection in Refineries," 7<sup>th</sup> ed., Washington, D.C.

[8.2] Oil Companies International Marine Forum (OCIMF), 1987, "Guide on Marine Terminal Fire Protection and Emergency Evacuation," 1<sup>st</sup> ed., Witherby, London.

[8.3] 2 CCR 2300-2407 (Title 2, California Code of Regulations, Sections 2300-2407).

[8.4] International Chamber of Shipping (ICS), Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH), 2006, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5<sup>th</sup> ed., Witherby, London.

[8.5] American Petroleum Institute, 1998, *API Recommended Practice 2003 (APIRP 2003)*, "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents," 6<sup>th</sup> ed., Washington, D.C.

[8.6] 33 CFR 154.550 (Title 33, Code of Federal Regulations, Section 1 54.550).

[8.7] National Fire Protection Association, 2008, *NFPA 70 (Article 500)*, "National Electrical Code," Quincy, MA.

[8.8] American Petroleum Institute, 1999, *API Publication 2218*, "Fireproofing Practices in Petroleum and Petrochemical Processing Plants," 2<sup>nd</sup> ed., Washington, D.C.

[8.9] National Fire Protection Association, 2010, *NFPA 72*, "National Fire Alarm and Signaling Code," Quincy, MA.

[8.10] National Fire Protection Association, 2011, *NFPA 25*, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," Quincy, MA.

Authority: Sections 8755 and 8757, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

## Division 9

### SECTION 3109F PIPING AND PIPELINES

**3109F.1 General.** This section provides minimum engineering standards for piping, pipelines, valves, supports and related appurtenances at MOTs. This section applies to piping and pipelines used for transferring:

1. Oil (see Section 3101F.1) to or from tank vessels or barges
2. Oil within the MOT
3. Vapors, including Volatile Organic Compounds (VOCs)
4. Inerting or enriching gases to vapor control systems

Additionally, it also applies to piping or pipelines providing services, which includes stripping, sampling, venting, vapor control and fire water.

See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

**3109F.2 Oil piping and pipeline systems.** All pressure piping and pipelines for oil service shall conform to the provisions of API Standard 2610 [9.1], ASME B31.3 [9.2] or B31.4 [9.3] as appropriate, including the following:

1. All piping/pipelines shall be documented on current P&ID's (N/E).
2. Piping and pipeline systems shall be installed above deck (N).
3. The systems shall be arranged in a way not to obstruct access to and removal of other piping components and equipment (N).
4. Flexibility shall be achieved through adequate expansion loops or joints (N/E).
5. A guide or lateral restraint shall be provided just past the elbow where a pipe changes direction in order to minimize excessive axial stress (N).
6. Piping shall be routed to allow for movement due to thermal expansion and seismic displacement, without exceeding the allowable stresses in the supports, and anchor connections (see Section 3109F.3) (N/E).
7. Plastic piping shall not be used unless designated for oil service (N/E).
8. If a flanged connection exists within 20 pipe diameters from the end of any replaced section, the pipe shall be replaced up to and including the flange.
9. Pipelines shall be seamless, electric-resistance-welded or electric-fusion-welded (N).
10. Piping greater than 2 inches in diameter shall be butt-welded. Piping 2 inches and smaller shall be socket welded or threaded.
11. Pipeline connections directly over the water shall be welded (N). Flanged connections not over water shall have secondary containment (N).

12. Pipelines that do not have a valid and certified Static Liquid Pressure Test (SLPT) [9.4] shall be marked “OUT OF SERVICE.” Out-of-service piping and pipelines shall be purged, gas-freed and physically isolated from sources of oil.

13. If a pipeline is “out-of-service” for 3 or more years, it will require Division approval prior to re-use.

**3109F.3 Pipeline stress analysis (N/E).** Pipeline stress analysis shall be performed for:

1. New piping and pipelines
2. Significant rerouting/relocation of existing piping
3. Any replacement of “not in-kind” piping
4. Any significant rearrangement or replacement of “not in-kind” anchors and/or supports
5. Significant seismic displacements calculated from the structural assessment

Pipeline stress analysis shall be performed in accordance with ASME B31.4 [9.3], considering all relevant loads and corresponding displacements determined from the structural analysis described in Section 3104F. Seismic loading of above-grade pipelines may be analyzed in accordance with ASME B31.E [9.5].

Flexibility analysis for piping, considering supports, shall be performed in accordance with ASME B31.4 [9.3] by using the largest temperature differential imposed by normal operation, start-up, shutdown or abnormal conditions. Thermal loads shall be based upon maximum and minimum local temperatures; heat traced piping shall use the maximum attainable temperature of the heat tracing system.

To determine forces at sliding surfaces, the coefficients of static friction shown in Table 31F-9-1 shall be used.

**TABLE 3109F-9-1  
COEFFICIENTS OF STATIC FRICTION**

SLIDING SURFACE MATERIALS	COEFFICIENT OF STATIC FRICTION
Teflon on Teflon	0.10
Plastic on Steel	0.35
Steel on Steel	0.40
Steel on Concrete	0.45
Steel on Timber	0.49

**3109F.4 Anchors and supports.** Anchors and supports shall conform to ASME B31.3 [9.2], ASME B31.4 [9.3], API Standard 2610 [9.1] and the ASCE Guidelines [9.6](N).

A seismic assessment shall be performed for existing anchors and supports using recommendations in Section 7 of CalARP [9.7] or Chapter 11 of FEMA 356 [9.8], as appropriate (E).

**3109F.5 Appurtenances.**

**3109F.5.1 Valves and fittings.** Valves and fittings shall meet the following requirements:

1. Conform to ASME B31.3 [9.2], ASME B31.4 [9.3], API Standard 609 [9.9] and ASME B16.34 [9.10], as appropriate, based on their service (N).



2. Conform to Section 8 of [9.1] (N/E).
3. Stems shall be oriented in a way not to pose a hazard in operation or maintenance (N/E).
4. Nonductile iron, cast iron, and low-melting temperature metals shall not be used in any hydrocarbon service, fire water or foam service (N/E).
5. Double-block and bleed valves shall be used for manifold valves. (N/E).
6. Isolation valves shall be fire-safe, in accordance with API Standard 607 [9.11] (N).
7. Swing check valves shall not be installed in vertical down-flow piping (N/E).
8. Pressure relief devices shall be used in any closed piping system that has the possibility of being overpressurized due to temperature increase (thermal relief valves) or surging (N/E).
9. Pressure relief devices shall be sized in accordance with API RP 520 [9.12] (N). Set pressures and accumulating pressures shall be in accordance with [9.12] (N/E).
10. Discharge from pressure relief valves shall be directed into lower pressure piping for recycling or proper disposal. Discharge shall never be directed into the open environment, unless secondary containment is provided (N/E).
11. Threaded, socket-welded, flanged and welded fittings shall conform to Section 8 of [9.1] (N/E).

#### 3109F.5.2 Valve actuators (N/E).

1. Actuators shall have a readily accessible, manually operated overriding device to operate the valve during a power loss.
2. Torque switches shall be set to stop the motor closing operation at a specified torque setting.
3. Limit switches shall be set to stop the motor opening operation at a specified limit switch setting.
4. Critical valves shall be provided with thermal insulation. The insulation shall be inspected and maintained at periodic intervals. Records of thermal insulation inspections and condition shall be maintained for at least 6 years.
5. Electrical insulation for critical valves shall be measured for resistance following installation and retested periodically. These records shall be maintained for at least 6 years.

**3109F.6 Utility and auxiliary piping systems.** Utility and auxiliary piping includes service for:

1. Stripping and sampling
2. Vapor control
3. Fire water and foam
4. Natural gas
5. Compressed air, venting and nitrogen

Stripping and sampling piping shall conform to Section 3109F.2 (N/E).

Vapor return lines and VOC vapor inerting and enriching (natural gas) piping shall conform to 33 CFR 154.808 [9.13] and API RP 1124 [9.14] (N/E).

Firewater and foam piping and fittings shall meet the following requirements:

1. Conform to ASME B16.5 [9.15]
2. Fire mains shall be carbon steel pipe (N/E)
3. High density polyethylene (HDPE) piping may be used for buried pipelines (N/E)
4. Piping shall be color-coded (N/E)

Compressed air, venting and nitrogen piping and fittings shall conform to ASME B 31.3 [9.2] (N). Utility and auxiliary piping shall have external visual inspections, similar to that defined in Section 10.1 of API 574 [9.16] (N/E).

#### 3109F.7 References.

- [9.1] American Petroleum Institute (API), 2005, API Standard 2610, "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2<sup>nd</sup> ed., Washington, D.C.
- [9.2] American Society of Mechanical Engineers (ASME), 2010, ASME B31.3, "Process Piping," New York.
- [9.3] American Society of Mechanical Engineers (ASME), 2009, ASME B31.4, "Pipeline Transportation Systems For Liquid Hydrocarbons And Other Liquids," New York.
- [9.4] 2 CCR 2560 - 2571 (Title 2, California Code of Regulations (CCR), Sections 2560-2571).
- [9.5] American Society of Mechanical Engineers (ASME), 2008, B31.E, "Standard for the Seismic Design and Retrofit of Above-Ground Piping Systems," New York.
- [9.6] American Society of Civil Engineers, 2011, "Guidelines for Seismic Evaluation and Design of Petrochemical Facilities," 2<sup>nd</sup> ed., New York.
- [9.7] CalARP Program Seismic Guidance Committee, September 2009, "Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.
- [9.8] Federal Emergency Management Agency, Nov. 2000, FEMA 356, "Prestandard and Commentary for the Seismic Rehabilitation of Buildings," Washington, D.C.
- [9.9] American Petroleum Institute (API), 1997, API Standard 609, "Butterfly Valves: Double Flanged, Lug- and Wafer-Type," 5<sup>th</sup> ed., Washington, D.C.
- [9.10] American Society of Mechanical Engineers (ASME), 1996, ASME B16.34, "Valves Flanged Threaded And Welding End," New York.
- [9.11] American Petroleum Institute (API), 1996, API Standard 607, "Fire Test for Soft-Seated Quar-

*ter-Turn Valves,*” 4<sup>th</sup> ed., 1993 (reaffirmed 4/1 996), Washington, D.C.

[9.12] American Petroleum Institute (API), 2000, *APIRP 520, “Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries, Part I—Sizing and Selection,”* 7<sup>th</sup> ed., and *Part II—Installation,* 2003, 5<sup>th</sup> ed., Washington, D.C.

[9.13] 33 CFR 1 54.808 — *Vapor Control Systems, General* (Title 33, Code of Federal Regulations (CFR), Section 1 54.808).

[9.14] American Petroleum Institute (API), 1991, *Recommended Practice 1124 (APIRP 1124), “Ship, Barge, and Terminal Hydrocarbon Vapor Collection Manifolds,”* 1<sup>st</sup> ed., Washington, D.C.

[9.15] American Society of Mechanical Engineers (ASME), 1996, *ASME B16.5, “Pipe Flanges and Flanged Fittings,”* New York.

[9.16] American Petroleum Institute (API), 2009, *API RP 574, “Inspection Practices for Piping System Components,”* 3<sup>rd</sup> ed., Washington, D.C.

*Authority: Sections 8755 and 8757, Public Resources Code.*

*Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

## Division 10

### SECTION 3110F MECHANICAL AND ELECTRICAL EQUIPMENT

**3110F.1 General.** This section provides the minimum standards for mechanical and electrical equipment at MOTs.

See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

#### 3110F.2 Marine loading arms.

**3110F.2.1 General criteria.** Marine loading arms and ancillary systems shall conform to 2 CCR 2380 (b) [10.1], 33 CFR 154.510 [10.2] and the “Design and Construction Specification for Marine Loading Arms,” [10.3].

The following shall be considered when determining the loading arm maximum allowable extension limits:

1. Vessel sizes and manifold locations
2. Lowest-low water level (datum)
3. Highest-high water level
4. Maximum vessel surge and sway
5. Maximum width of fendering system

#### 3110F.2.2 Electrical and hydraulic power systems.

##### 3110F.2.2.1 Pressure and control systems (N).

1. Pressure gauges shall be mounted in accordance with ASME B40.100-1 998 [10.4].
2. The hydraulic drive cylinders shall be mounted and meet either the mounting requirements of ANSI/(NFPA) T3. 6.7 R2 -1 996 [10.5] or equivalent.
3. In high velocity current (> 1.5 knots) areas, all new marine loading arms shall be fitted with quick disconnect couplers and emergency quick release systems in conformance with Sections 6.0 and 7.0 of [10.3]. In complying with this requirement, attention shall be paid to the commentary and guidelines in Part III of reference [10.3].
4. Out-of-limit, balance and the approach of out-of-limit alarms shall be located at or near the loading arm console.

##### 3110F.2.2.2 Electrical components (N). The following criteria shall be implemented:

1. Equipment shall be provided with a safety disconnecting device to isolate the entire electrical system from the electrical mains in accordance with Article 430 of the National Electrical Code (NEC), [10.6].
2. Motor controllers and 3-pole motor overload protection shall be installed and sized in accordance with Article 430, NEC [10.6].
3. Control circuits shall be limited to 120 volts and shall comply with Articles 500 and 501 of the NEC [10.6]. Alternatively, intrinsically safe wiring and

controls may be provided in accordance with Article 504, NEC [10.6] and ANSI/UL Std. No. 913 [10.7].

4. Grounding and bonding shall comply with the requirements of Article 430, NEC [10.6] and Section 3111F.

Section 3111F includes requirements for electrical equipment, wiring, cables, controls and electrical auxiliaries located in hazardous areas.

**3110F.2.2.3 Remote operation.** The remote control system, where provided, shall conform to the recommendations of the OCIMF [10.3]. The remote operation shall be facilitated by either a pendant control system or by a hand-held radio controller (N).

The pendant control system shall be equipped with a plug-in capability to an active connector located either in the vicinity of the loading arms, or at the loading arm outboard end on the triple swivel, and hard-wired into the control console. The umbilical cord running from the triple swivel to the control console shall be attached to the loading arm. Other umbilical cords shall have sufficient length to reach the maximum operational limits (N).

The radio controller if installed shall comply with 2 CCR 2370(e) [10.8] and 47CFR Part 15 [10.9] requirements for transmitters operating in an industrial environment (N/E).

**3110F.3 Oil transfer hoses (N/E).** Hoses for oil transfer service shall be in compliance with 2 CCR 2380 (a) [10.10] and 33 CFR 154.500 [10.11].

Hoses with diameters of 6 inches or larger shall have flanges that meet ANSIB1 6.5 [10.12]. Hoses with diameters of 4 inches or less may have quick disconnect fittings provided that they meet ASTM F-1122 [10.13].

**3110F.4 Lifting equipment: winches and cranes.** Lifting equipment shall conform to [10.14], [10.15], [10.16] and [10.17]. Electrical equipment shall conform to the provisions of Section 3111F.

##### 3110F.4.1 Winches.

1. Winches and ancillary equipment shall be suitable for a marine environment (N/E).
2. Winches shall be provided with a fail-safe braking system, capable of holding the load under all conditions, including a power failure (N/E).
3. Winches shall be fully reversible (N).
4. Shock, transient and abnormal loads shall be considered when selecting winch systems (N).
5. Winches shall have limit switches and automatic trip devices to prevent over-travel of the drum in either direction. Limit switches shall be tested, and demonstrated to function correctly under operating condi-

tions without inducing undue tensions or slack in the winch cables (N/E).

6. Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums (N/E).
7. Moving winch parts which present caught-in hazards to personnel shall be guarded (N/E).
8. Winches shall have clearly identifiable and readily accessible stop controls (N/E).

#### **3110F.4.2 Cranes (N/E).**

1. Cranes shall not be loaded in excess of the manufacturer's rating except during performance tests.
2. Drums on load-hoisting equipment shall be equipped with positive holding devices.
3. Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums.
4. Braking equipment shall be capable of stopping, lowering, and holding a load of at least the full test load.
5. When not in use, crane booms shall be lowered to ground level or secured to a rest support against displacement by wind loads or other outside forces.
6. Safety systems including devices that affect the safe lifting and handling, such as interlocks, limit switches, load/moment and overload indicators with shutdown capability, emergency stop switches, radius and locking indicators, shall be provided [10.18].

**3110F.5 Shore-to-vessel access for personnel.** This section applies to shore-to-vessel means of access for personnel and equipment provided by the terminal. This includes ancillary structures and equipment, which support, supplement, deploy and maneuver such vessel access systems.

Shore-to-vessel access for personnel shall conform to 29 CFR 1918.22 [10.19], Sections 19(b) and 21(b) of [10.20], Chapter 16.4 of [10.21] and the following:

1. Shore-to-vessel access systems shall be designed to withstand the forces from dead, live, wind, vibration, impact loads and the appropriate combination of these loads. The design shall consider all the critical positions of the system in the stored, maintenance, maneuvering and deployed positions, where applicable (N).
2. The minimum live load shall be 50 psf on walkways and 25 plf with a 200 pounds minimum concentrated load in any location or direction on handrails (N).
3. The walkway shall be not less than 36 inches in width (N) and not less than 20 inches for existing walkways (E).
4. The shore-to-vessel access system shall be positioned so as to not interfere with the safe passage or evacuation of personnel (N/E).
5. Guardrails shall be provided on both sides of the access systems with a clearance between the inner most surfaces of the guardrails of not less than 36 inches and

shall be maintained for the full length of the walkway (N).

6. Guardrails shall be at a height not less than 33 inches above the walkway surface and shall include an intermediate rail located midway between the walkway surface and the top rail (N/E).
7. The walkway surface, including self-leveling treads, if so equipped, shall be finished with a safe nonslip footing accommodating all operating gangway inclinations (N/E).
8. Under no circumstances shall the operating inclination of the walkway exceed 60 degrees from the horizontal or the maximum angle recommended by the manufacturer, whichever is less (N/E).
9. The undersides of aluminum gangways shall be protected with hard plastic or wooden strips to prevent being dragged or rubbed across any steel deck or component (N/E).

**3110F.6 Sumps, discharge containment and ancillary equipment.** Sumps, discharge containment and ancillary equipment shall conform to 2 CCR 2380(f) [10.22], 33 CFR 154.530 [10.23] and the following:

1. Sumps for oil drainage shall be equipped with pressure/vacuum vents, automatic draining pumps and shall be tightly covered (N/E).
2. Sumps which provide drainage for more than one berth should be equipped with liquid seals so that a fire on one berth does not spread via the sump (N/E).
3. Sumps shall be located at least 25ft from the manifolds, base of the loading arms or hose towers (N).
4. Conduct periodic integrity testing of the sump containers and periodic integrity and leak testing of the related valves and piping.

**3110F.7 Vapor control systems.** Vapor control systems shall conform to 33 CFR 154.800 through 154.850 [10.24] and API Standard 2610 [10.25]. The effects of seismic, wind, dead, live and other loads shall be considered in the analysis and design of individual tie-downs of components, such as of steel skirts, vessels, controls and detonation arresters. The analysis and design shall include the load transfer to supporting deck/pile structures or foundation elements.

**3110F.8 Equipment anchors and supports.** For new (N) electrical and mechanical equipment, the seismic lateral loads (demand) shall be calculated using the methods of Section 6.4 of FEMA 450 [10.26]. The design for load transfer to the wharf deck shall use the same procedures as for mooring and berthing components (see Section 3107F.5.3).

For existing (E) equipment, the seismic assessment shall be performed in accordance with CalARP [10.27], FEMA 356 [10.28] or ASCE Guidelines [10.29].

**3110F.9 Equipment and systems maintenance (N/E).** Mechanical and electrical equipment critical to oil spill prevention, such as, but not limited to: mooring line quick release and loading arm quick disconnect systems, shall be maintained and tested as per the manufacturer's recommendations (N/E).



*The latest records shall be readily accessible to the Division (N/E).*

**3110F.10 Pumps (N/E).** *Specification information for all MOT pumps providing oil and fire water service to wharf pipeline systems shall be retained. Information shall include, but not be limited to, pump make and model, motor make and model, flow rate, pressure rating and pump performance curves.*

*Hydrocarbon pumps that serve the oil transfer operations at the berthing system must be maintained per API 2610 [10.25]. Firewater pumps providing the wharf fire protection shall be maintained per NFPA 25 [10.30], as adopted and amended by the State Fire Marshal, or local enforcing agency requirements.*

**3110F.11 Critical systems seismic assessment (N/E).** *Critical mechanical and electrical equipment related to personnel safety, oil spill prevention or response, shall have a seismic assessment per Section 3104F.5.3. For equipment anchorages and supports, see Section 3110F.8.*

#### **3110F.12 References.**

- [10.1] 2 CCR 2380(b), Title 2, California Code of Regulations, Section 2380(b), Loading Arms.
- [10.2] 33 CFR 154.510, Title 33 Code of Federal Regulations Section 1 54.510.
- [10.3] Oil Companies International Marine Forum (OCIMF), 1999, "Design and Construction Specification for Marine Loading Arms," 3<sup>rd</sup> ed., Witherby, London.
- [10.4] American Society of Mechanical Engineers (ASME), 2000, ASME B40.100-1998, "Pressure Gauges and Gauge Attachments," New York.
- [10.5] National Fluid Power Association (NFPA), 1996, ANSI/(NFPA) T3. 6. 7R2-1996, "Fluid Power Systems and Products —Square Head Industrial Cylinders - Mounting Dimensions," Milwaukee, WI.
- [10.6] National Fire Protection Association, 2002, NFPA 70, "National Electrical Code," Quincy, MA.
- [10.7] Underwriters Laboratory, Inc., 1997, "Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations," ANSI/UL Standard No. 913, 5<sup>th</sup> ed., Northbrook, IL.
- [10.8] 2 CCR2370(e), Title 2 California Code of Regulations, Section 2370(e).
- [10.9] 47 CFR Part 15 Private Land Mobile Radio Services, Title 47 Code of Federal Regulations (CFR).
- [10.10] 2 CCR 2380(a), Title 2, California Code of Regulations, Section 2380(a).
- [10.11] 33 CFR 1 54.500 Hose Assemblies, Title 33 Code of Federal Regulations Section 1 55.500.
- [10.12] American Society of Mechanical Engineers, 1996, ASME/ANSI B16.5, "Pipe Flanges and Flanged Fittings," New York.
- [10.13] American Society for Testing and Materials, 2001, ASTM F-1122-87 (1998), "Standard Specification for Quick Disconnect Couplings," West Conshohocken, PA.
- [10.14] 29 CFR 1918, Subpart F, Title 29 Code of Federal Regulations Section 1918, Subpart F.
- [10.15] American Society of Mechanical Engineers, 1996, ASME B30.4 - 1996, "Portal Tower and Pedestal Cranes," New York.
- [10.16] American Society of Mechanical Engineers, 2002, ASME B30. 7 - 2001, "Base Mounted Drum Hoists," New York.
- [10.17] American Society of Mechanical Engineers, 1999, ASME HST-4, "Performance Standard for Overhead Electric Wire-Rope Hoists," New York.
- [10.18] 29 CFR 1917.46, Title 29 Code of Federal Regulations Section 1917.46 Load Indicating Devices.
- [10.19] 29 CFR 1918.22, Title 29 Code of Federal Regulations Section 1918.22, Gangways.
- [10.20] US Army Corps of Engineers, 1996, "Safety and Health Requirements Manual, Sections 19(b) and 21(b)," EM 385-1 -1, Washington, D.C.
- [10.21] Chapter 16.4, Ship/Shore Access, International Safety Guide for Oil Tankers and Terminals, 5th ed. 2006, Witherby, London.
- [10.22] 2 CCR 2380 (f), Title 2, California Code of Regulations, Section 2380 (f), Small Discharge Containment.
- [10.23] 33 CFR 154.530, Title 33, Code of Federal Regulations, Section 1 54.530 Small Discharge Containment.
- [10.24] 33 CFR 1 54.800 through 1 54.850, Title 33 Code of Federal Regulations, Sections 1 54.800 through 1 54.850.
- [10.25] American Petroleum Institute (API), 2005, API Standard 2610, "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2<sup>nd</sup> ed., Washington, D.C.
- [10.26] Federal Emergency Management Agency, 2003, "NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (FEMA 450)," Part 1 — Provisions, Washington D.C.
- [10.27] CalARP Program Seismic Guidance Committee, September 2009, "Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.
- [10.28] Federal Emergency Management Agency, Nov. 2000, FEMA 356, "Prestandard and Commentary for the Seismic Rehabilitation of Buildings," Washington, D.C.

[10.29] *American Society of Civil Engineers, 1997, "Guidelines for Seismic Evaluation and Design of Petrochemical Facilities," New York, NY.*

[10.30] *National Fire Protection Association, 2011, NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, Quincy, MA.*

*Authority: Sections 8755 and 8757, Public Resources Code.*

*Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

## Division 11

SECTION 3111F  
ELECTRICAL SYSTEMS

**3111F.1 General.** This section provides minimum standards for electrical systems at marine oil terminals.

Electrical systems include the incoming electrical service and components, the electrical distribution system, branch circuit cables and the connections. Also included are:

1. Lighting, for operations, security and navigation
2. Controls for mechanical and electrical equipment
3. Supervision and instrumentation systems for mechanical and electrical equipment
4. Grounding and bonding
5. Corrosion protection through cathodic protection
6. Communications and data handling systems
7. Fire detection systems
8. Fire alarm systems
9. Emergency shutdown systems (ESD)

All electrical systems shall conform to API RP 540 [11.1] and the National Electrical Code (NEC) [11.2].

See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

**3111F.2 Hazardous area designations and plans (N/E).** Area classifications shall be determined in accordance with API RP 500 [11.3], API RP 540 [11.1] and the NEC, Articles 500, 501, 504, 505 and 515 [11.2]. A marine oil terminal shall have a current set of scaled plan drawings, with clearly designated areas showing the hazard class, division and group. The plan view shall be supplemented with sections, elevations and details to clearly delineate the area classification at all elevations starting from low water level. The drawings shall be certified by a professional electrical engineer. The plans shall be reviewed, and revised when modifications to the structure, product or equipment change hazardous area identifications or boundaries.

**3111F.3 Identification and tagging.** All electrical equipment, cables and conductors shall be clearly identified by means of tags, plates, color coding or other effective means to facilitate troubleshooting and improve safety, and shall conform to the identification carried out for the adjacent on-shore facilities (N). Topics for such identification are found in the NEC Articles 110, 200, 210, 230, 384, 480 and 504 [11.2]. Existing electrical equipment (E) shall be tagged.

Where identification is necessary for the proper and safe operation of the equipment, the marking shall be clearly visible and illuminated (N/E). A coded identification system shall apply to all circuits, carrying low or high voltage power, control, supervisory or communication (N).

**3111F.4 Purged or pressurized equipment in hazardous locations (N/E).** Purged or pressurized enclosures shall be capable of preventing the entry of combustible gases into such spaces, in accordance with NFPA 496 [11.4]. Special emphasis shall

be placed on reliability and ease of operation. The pressurizing equipment shall be electrically monitored and alarms shall be provided to indicate failure of the pressurizing or purging systems.

**3111F.5 Electrical service.** Where critical circuits are used for spill prevention, fire control or life safety, an alternative service derived from a separate source and conduit system, shall be located at a safe distance from the main power service. A separate feeder from a double-ended substation or other source backed up by emergency generators will meet this requirement. An uninterrupted power service (UPS) shall be provided for control and supervisory circuits associated with ESD systems (N).

1. Electrical, instrument and control systems used to activate equipment needed to control a fire or mitigate its consequences shall be protected from fire and remain operable for 15 minutes in a 2000°F fire, unless designed to fail-safe during fire exposure. The temperature around these critical components shall not exceed 200°F during 15 minutes of fire exposure (N).
2. Wiring in fireproofed conduits shall be derated 15 percent to account for heat buildup during normal operation. Type MI (mineral insulated, metal sheathed [11.2]) cables may be used in lieu of fireproofing of wiring (N).
3. Emergency cables and conductors shall be located where they are protected from damage caused by traffic, corrosion or other sources (N).
4. Allowance shall be made for electrical faults, overvoltages and other abnormalities (N).

Where solid state motor controls are used for starting and speed control, corrective measures shall be incorporated for mitigating the possible generation of harmonic currents that may affect the ESD or other critical systems (N).

**3111F.5.1 Emergency power systems.** Emergency power systems shall be installed (N) and maintained (N/E) per NFPA-110 [11.6]. This does not include stored energy systems. Stored energy emergency power systems (SEEPS) shall be installed (N) when necessary to maintain continuous uninterruptable power to critical systems. SEEPS shall be installed (N) and maintained (N/E) per NFPA-111 [11.7].

**3111F.6 Grounding and bonding (N/E).**

1. All electrical equipment shall be effectively grounded as per NEC Article 250 [11.2]. All noncurrent carrying metallic equipment, structures, piping and other elements shall also be effectively grounded.
2. Grounding shall be considered in any active corrosion protection system for on-shore piping, submerged support structures or other systems. Insulation barriers, including flanges or nonconducting hoses shall be used to isolate cathodic protection systems from other electrical/static sources. None of these systems shall be compromised by grounding or bonding arrangements that may interconnect the corrosion protection systems or

interfere with them in any way that would reduce their effectiveness.

3. Bonding of vessels to the MOT structure is not permitted (2 CCR 2341 (f)) [11.5].
4. Whenever flanges of pipelines with cathodic protection are to be opened for repair or other work, the flanges shall be bonded prior to separation.
5. Direct wiring to ground shall be provided from all towers, loading arms or other high structures that are susceptible to lightning surges or strikes.

**3111F.7 Equipment specifications (N).** All electrical systems and components shall conform to National Electrical Manufacturers Association (NEMA) standards or be certified by a Nationally Recognized Testing Laboratory (NRTL).

**3111F.8 Illumination (N/E).** Lighting shall conform to 2 CCR 2365 [11.8] and 33 CFR 154.570 (d) [11.9].

### 3111F.9 Communications, control and monitoring systems.

**3111F.9.1 Communication systems (N/E).** Communications systems shall comply with 2 CCR 2370 [11.10], and conform to Section 6 of [11.11].

**3111F.9.2 Overfill monitoring and controls (N/E).** Overfill protection systems shall conform to Appendix C of API RP 2350 [11.12]. These systems shall be tested before each transfer operation or monthly, whichever is less frequent. Where vessel or barge overfill sensors and alarms are provided, they shall comply with 33 CFR 154.812 [11.13].

All sumps shall be provided with level sensing devices to initiate an alarm to alert the operator at the approach of a high level condition. A second alarm shall be initiated at a high-high level to alert the operator. Unless gravity drainage is provided, sumps must have an automatic pump, programmed to start at a predetermined safe level.

**3111F.9.3 Monitoring systems (N/E).** All monitoring systems and instrumentation such as, but not limited to: velocity monitoring systems, tension monitoring systems, anemometers, and current meters, shall be installed, maintained and calibrated per the manufacturer's recommendations. Specifications shall be retained. The latest records shall be readily accessible to the Division.

### 3111F.10 Corrosion protection.

**3111F.10.1 Corrosion assessment (N/E).** An assessment shall be performed to determine the existing and potential corrosion. This assessment shall include all steel or metallic components, including the structure, pipelines, supports or other ancillary equipment, with drawings and specifications for corrosion prevention/protection. The assessment shall be performed by a licensed professional engineer, using the methods and criteria prescribed in [11.14].

**3111F.10.2 Inspection, testing and records (N/E).** For sacrificial anode systems, periodic underwater inspections shall be performed and observations recorded. For impressed current systems, monthly rectifier readings and annual potential readings of the protected components shall be taken. If potential readings for steel structures are outside of acceptable limits (between -0.85 [11.15] and -1.10

Volts), corrective actions shall be taken. Voltage drops other than across the structure-to-electrolyte boundary must be considered for valid interpretations of potential measurement. Consideration is understood to mean the application of sound engineering practice in determining the significance of voltage drops by methods such as:

1. Measuring or calculating voltage drop(s)
2. Reviewing historical performance of the cathodic protection system (CPS)
3. Evaluating the physical and electrical characteristics of the structure and the environment
4. Determining whether or not there is physical evidence of corrosion

All isolating sections shall be tested immediately after installation or replacement, and, at a minimum, annually. Test results shall be recorded and documented. Electrical tests on insulating flanges shall make use of specialized insulator testers. The test instrument shall make use of RF signals, capacitive measurements or other means to clearly determine whether an insulating flange is shorted or open circuited without being affected by pipe-to-soil potentials, cathodic protection voltages or whether it is buried or exposed.

The cathodic protection inspection for buried or submerged pipelines shall conform to API 570 [11.16].

Insulating and isolating arrangements for protection against static, stray and impressed currents shall be tested in accordance with 2 CCR 2341(d) and 2380 [11.17].

**3111F.11 Critical systems seismic assessment (N/E).** Electrical power systems shall have a seismic assessment per Section 3104F.5.3. For equipment anchorages and supports, see Section 3110F.8.

### 3111F.12 References.

- [11.1] American Petroleum Institute, 1999, API Recommended Practice 540 (API RP 540), "Electrical Installations in Petroleum Processing Plants," 4<sup>th</sup> ed., Washington, D.C.
- [11.2] National Fire Protection Association, 2002, NFPA 70, "National Electrical Code (NEC)," Quincy, MA.
- [11.3] American Petroleum Institute, 1997, API Recommended Practice 500 (API RP 500), "Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2," 2<sup>nd</sup> ed., Washington, D.C.
- [11.4] National Fire Protection Association, 1998, NFPA 496, "Standard for Purged and Pressurized Enclosures for Electrical Equipment," Quincy, MA.
- [11.5] 2 CCR 2341(f), Title 2, California Code of regulations, Section 2341(f).
- [11.6] National Fire Protection Association, 2010, NFPA 110, "Standard for Emergency and Standby Power Systems," Quincy, MA.



- [11.7] *National Fire Protection Association, 2011, NFPA 111, "Standard on Stored Electrical Energy Emergency and Standby Power Systems," Quincy, MA.*
- [11.8] *2 CCR 2365, Title 2 California Code of Regulations, Section 2365.*
- [11.9] *33 CFR 154.570(d), Title 33 Code of Federal Regulations Section 154.570(d).*
- [11.10] *2 CCR 2370, Title 2 California Code of Regulations, Section 2370.*
- [11.11] *Oil Companies International Marine Forum (OCIMF), 1987, "Guide on Marine Terminal Fire Protection and Emergency Evacuation," 1<sup>st</sup> ed., Witherby, London.*
- [11.12] *American Petroleum Institute, 1996, API Recommended Practice 2350 (API RP 2350), "Overfill Protection for Storage Tanks," 2<sup>nd</sup> ed., Washington, D.C.*
- [11.13] *33 CFR 154.812, Title 33, Code of Federal Regulations, Section 154.812 - Facility Requirements for Vessel Liquid Overfill Protection.*
- [11.14] *National Association of Corrosion Engineers (NACE), Standard Recommended Practice, 1994, RP01 76-1 994 "Corrosion Control of Steel Fixed Offshore Platforms Associated with Petroleum Production," Houston, TX.*
- [11.15] *Department of Defense, 31 January 1990, Military Handbook, "Electrical Engineering Cathodic Protection," MIL-HDBK-1004/10, Washington, D.C.*
- [11.16] *American Petroleum Institute, 2002, API570, "Piping Inspection Code," 2<sup>nd</sup> ed., October 1998 (February 2000 Addendum 1), Washington, D.C.*
- [11.17] *2 CCR 2341(d) and 2380, Title 2, California Code of Regulations, Sections 2341(d) and 2380.*

*Authority: Sections 8755 and 8757, Public Resources Code.*

*Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 32 – ENCROACHMENT INTO PUBLIC RIGHT-OF-WAY

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X	X	X	X			X	X												
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter / Section																				

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 32

# ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

### SECTION 3201 GENERAL

**3201.1 Scope.** The provisions of this chapter shall govern the encroachment of structures into the public right-of-way.

**3201.2 Measurement.** The projection of any structure or portion thereof shall be the distance measured horizontally from the lot line to the outermost point of the projection.

**3201.3 Other laws.** The provisions of this chapter shall not be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

**3201.4 Drainage.** Drainage water collected from a roof, awning, canopy or marquee, and condensate from mechanical equipment shall not flow over a public walking surface.

### SECTION 3202 ENCROACHMENTS

**3202.1 Encroachments below grade.** Encroachments below grade shall comply with Sections 3202.1.1 through 3202.1.3.

**3202.1.1 Structural support.** A part of a building erected below grade that is necessary for structural support of the building or structure shall not project beyond the lot lines, except that the footings of street walls or their supports which are located not less than 8 feet (2438 mm) below grade shall not project more than 12 inches (305 mm) beyond the street lot line.

**3202.1.2 Vaults and other enclosed spaces.** The construction and utilization of vaults and other enclosed spaces below grade shall be subject to the terms and conditions of the applicable governing authority.

**3202.1.3 Areaways.** Areaways shall be protected by grates, guards or other approved means.

**3202.2 Encroachments above grade and below 8 feet in height.** Encroachments into the public right-of-way above grade and below 8 feet (2438 mm) in height shall be prohibited except as provided for in Sections 3202.2.1 through 3202.2.3. Doors and windows shall not open or project into the public right-of-way.

**3202.2.1 Steps.** Steps shall not project more than 12 inches (305 mm) and shall be guarded by approved devices not less than 3 feet (914 mm) in height, or shall be located between columns or pilasters.

**3202.2.2 Architectural features.** Columns or pilasters, including bases and moldings shall not project more than 12 inches (305 mm). Belt courses, lintels, sills, architraves, pediments and similar architectural features shall not project more than 4 inches (102 mm).

**3202.2.3 Awnings.** The vertical clearance from the public right-of-way to the lowest part of any awning, including valances, shall be not less than 7 feet (2134 mm).

**3202.3 Encroachments 8 feet or more above grade.** Encroachments 8 feet (2438 mm) or more above grade shall comply with Sections 3202.3.1 through 3202.3.4.

**3202.3.1 Awnings, canopies, marquees and signs.**

Awnings, canopies, marquees and signs shall be constructed so as to support applicable loads as specified in Chapter 16. Awnings, canopies, marquees and signs with less than 15 feet (4572 mm) clearance above the sidewalk shall not extend into or occupy more than two-thirds the width of the sidewalk measured from the building. Stanchions or columns that support awnings, canopies, marquees and signs shall be located not less than 2 feet (610 mm) in from the curb line.

**3202.3.2 Windows, balconies, architectural features and mechanical equipment.**

Where the vertical clearance above grade to projecting windows, balconies, architectural features or mechanical equipment is more than 8 feet (2438 mm), 1 inch (25 mm) of encroachment is permitted for each additional 1 inch (25 mm) of clearance above 8 feet (2438 mm), but the maximum encroachment shall be 4 feet (1219 mm).

**3202.3.3 Encroachments 15 feet or more above grade.** Encroachments 15 feet (4572 mm) or more above grade shall not be limited.

**3202.3.4 Pedestrian walkways.** The installation of a pedestrian walkway over a public right-of-way shall be subject to the approval of the applicable governing authority. The vertical clearance from the public right-of-way to the lowest part of a pedestrian walkway shall be not less than 15 feet (4572 mm).

**3202.4 Temporary encroachments.** Where allowed by the applicable governing authority, vestibules and storm enclosures shall not be erected for a period of time exceeding seven months in any one year and shall not encroach more than 3 feet (914 mm) nor more than one-fourth of the width of the sidewalk beyond the street lot line. Temporary entrance awnings shall be erected with a clearance of not less than 7 feet (2134 mm) to the lowest portion of the hood or awning where supported on removable steel or other approved non-combustible support.





## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 33 – SAFEGUARDS DURING CONSTRUCTION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X	X					X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below			X	X		X														
Chapter / Section																				
3303			X	X																
3304			X	X																
3305			X	X																
3306			X	X																
3306.2						X														
3307			X	X																
3308			X	X																
3310			X	X																

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*



## CHAPTER 33

# SAFEGUARDS DURING CONSTRUCTION

### SECTION 3301 GENERAL

**3301.1 Scope.** The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties.

**3301.2 Storage and placement.** Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

### SECTION 3302 CONSTRUCTION SAFEGUARDS

**3302.1 Alterations, repairs and additions.** Required *exits*, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during alterations, repairs or additions to any building or structure.

#### Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required when the existing building is not occupied.

**3302.2 Manner of removal.** Waste materials shall be removed in a manner which prevents injury or damage to persons, adjoining properties and public rights-of-way.

**3302.3 Fire safety during construction.** Fire safety during construction shall comply with the applicable requirements of this code and the applicable provisions of Chapter 33 of the *California Fire Code*.

### SECTION 3303 DEMOLITION

**3303.1 Construction documents.** Construction documents and a schedule for demolition shall be submitted where required by the building official. Where such information is required, no work shall be done until such construction documents or schedule, or both, are approved.

**3303.2 Pedestrian protection.** The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by this chapter.

**3303.3 Means of egress.** A horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

**3303.4 Vacant lot.** Where a structure has been demolished or removed, the vacant lot shall be filled and maintained to the existing grade or in accordance with the ordinances of the jurisdiction having authority.

**3303.5 Water accumulation.** Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

**3303.6 Utility connections.** Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the applicable governing authority.

**3303.7 Fire safety during demolition.** Fire safety during demolition shall comply with the applicable requirements of this code and the applicable provisions of Chapter 56 of the *California Fire Code*.

### SECTION 3304 SITE WORK

**3304.1 Excavation and fill.** Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed from the soil to a depth of not less than 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms which have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

**3304.1.1 Slope limits.** Slopes for permanent fill shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the presentation of a soil investigation report acceptable to the building official.

**3304.1.2 Surcharge.** No fill or other surcharge loads shall be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or surcharge. Existing footings or foundations which can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against later movement.

**3304.1.3 Footings on adjacent slopes.** For footings on adjacent slopes, see Chapter 18.

**3304.1.4 Fill supporting foundations.** Fill to be used to support the foundations of any building or structure shall comply with Section 1804.5. Special inspections of compacted fill shall be in accordance with Section 1704.7.

**3304.1.5 [HCD] Storm water drainage and retention during construction.** Projects which disturb less than one acre of soil and are not part of a larger common plan of development which in total disturbs one acre or more,

shall manage storm water drainage during construction in accordance with the *California Green Building Standards Code (CALGreen)*, Chapter 4, Division 4.1.

### SECTION 3305 SANITARY

**3305.1 Facilities required.** Sanitary facilities shall be provided during construction, remodeling or demolition activities in accordance with the *California Plumbing Code*.

### SECTION 3306 PROTECTION OF PEDESTRIANS

**3306.1 Protection required.** Pedestrians shall be protected during construction, remodeling and demolition activities as required by this chapter and Table 3306.1. Signs shall be provided to direct pedestrian traffic.

**3306.2 Walkways.** A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but in no case shall they be less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface. Walkways shall be accessible in accordance with *Chapter 11A or 11B as applicable*, and shall be designed to support all imposed loads and in no case shall the design live load be less than 150 pounds per square foot (psf) (7.2 kN/m<sup>2</sup>).

**3306.3 Directional barricades.** Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

**3306.4 Construction railings.** Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

**3306.5 Barriers.** Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors which are normally kept closed.

**3306.6 Barrier design.** Barriers shall be designed to resist loads required in Chapter 16 unless constructed as follows:

1. Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be boards not less than  $\frac{3}{4}$ -inch (19.1 mm) thick or wood structural panels not less than  $\frac{1}{4}$ -inch (6.4 mm) thick.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.
4. Wood structural use panels  $\frac{1}{4}$  inch (6.4 mm) or  $\frac{5}{16}$  inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center (o.c.).
5. Wood structural use panels  $\frac{3}{8}$  inch (9.5 mm) or  $\frac{1}{2}$  inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center provided a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at midheight where the stud spacing is greater than 2 feet (610 mm) on center.
6. Wood structural use panels  $\frac{5}{8}$  inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).

**3306.7 Covered walkways.** Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. In no case shall the design live load be less than 150 psf (7.2 kN/m<sup>2</sup>) for the entire structure.

**Exception:** Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6kN/m<sup>2</sup>) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.

TABLE 3306.1  
PROTECTION OF PEDESTRIANS

HEIGHT OF CONSTRUCTION	DISTANCE FROM CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
8 feet or less	Less than 5 feet	Construction railings
	5 feet or more	None
More than 8 feet	Less than 5 feet	Barrier and covered walkway
	5 feet or more, but not more than one-fourth the height of construction	Barrier and covered walkway
	5 feet or more, but between one-fourth and one-half the height of construction	Barrier
	5 feet or more, but exceeding one-half the height of construction	None

For SI: 1 foot = 304.8 mm.

4. Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.
5. The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification not less than  $23/32$  inch (18.3 mm) thick nailed to the joists.
6. Each post shall be knee braced to joists and stringers by members not less than 2-inch by 4-inch (51 mm by 102 mm); 4 feet (1219 mm) in length.
7. A curb which is not less than 2-inch by 4-inch (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.

**3306.8 Repair, maintenance and removal.** Pedestrian protection required by this chapter shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's agent, upon the completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

**3306.9 Adjacent to excavations.** Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16.

### SECTION 3307 PROTECTION OF ADJOINING PROPERTY

**3307.1 Protection required.** Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

### SECTION 3308 TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

**3308.1 Storage and handling of materials.** The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.

**3308.1.1 Obstructions.** Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes,

catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

**3308.2 Utility fixtures.** Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

### SECTION 3309 FIRE EXTINGUISHERS

**[F] 3309.1 Where required.** All structures under construction, alteration or demolition shall be provided with no fewer than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

**[F] 3309.2 Fire hazards.** The provisions of this code and the *California Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

### SECTION 3310 MEANS OF EGRESS

**3310.1 Stairways required.** Where a building has been constructed to a building height of 50 feet (15 240 mm) or four stories, or where an existing building exceeding 50 feet (15 240 mm) in building height is altered, no fewer than one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.

**3310.2 Maintenance of means of egress.** Required means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

**Exception:** Existing means of egress need not be maintained where approved temporary means of egress systems and facilities are provided.

### SECTION 3311 STANDPIPES

**[F] 3311.1 Where required.** In buildings required to have standpipes by Section 905.3.1, no fewer than one standpipe shall be provided for use during construction. Such stand-

## SAFEGUARDS DURING CONSTRUCTION

pipes shall be installed when the progress of construction is not more than 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairs. Such standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.

**[F] 3311.2 Buildings being demolished.** Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

**[F] 3311.3 Detailed requirements.** Standpipes shall be installed in accordance with the provisions of Chapter 9.

**Exception:** Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 as to capacity, outlets and materials.

### SECTION 3312 AUTOMATIC SPRINKLER SYSTEM

**[F] 3312.1 Completion before occupancy.** In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 111.3.

**[F] 3312.2 Operation of valves.** Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

### SECTION 3313 WATER SUPPLY FOR FIRE PROTECTION

**[F] 3313.1 Where required.** An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material arrives on the site.

## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 34 – EXISTING STRUCTURES

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD		DSA				OSHDPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				
Adopt entire chapter as amended (amended sections listed below)			X	X						X	X									
Adopt only those sections that are listed below	X	X				X	X	X												
Chapter/Section																				
3401	X																			
3401.1			X	X			X	X												
3401.1 (Last Paragraph only)						X														
3401.1.1	X																			
3401.1		X																		
3401.2		X																		
3401.3		X	X	X																
3401.1.2							X													
3401.1.3								X												
3401.3			X	X																
3401.4		X																		
3401.4.1		X	X	X																
3401.4.2		X																		
3401.5										X										
3401.6		X	f	f																
3401.7	X									X	X									
3401.8	X																			
3402	X	X			X	X	X	X												
3402.1										X	X									
3403	X																			
3403.1 <i>Exception</i>	X																			
3403.2 <i>Equation</i>	X																			
3403.5			f	f																
3404	X																			
3404.1 <i>Exception #3</i>	X																			
3404.1.1			X	X																
3404.6		X	f	f																
3405	X																			
3405.1 <i>Exception</i>	X																			
3405.1.1		X	X	X																
3405.2			f	f																
3405.3			f	f																
3406	X	X	f	f																
3407			f	f																

(continued)



## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE

### CHAPTER 34 – EXISTING STRUCTURES—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				
Adopt entire chapter as amended (amended sections listed below)			X	X						X	X									
Adopt only those sections that are listed below	X	X				X	X	X												
Chapter/Section																				
3408	X	X																		
3409			†	†																
3409 (1st Paragraph)						X														
3409																				
3410.1			X	X																
3410.2																				
3411			†	†																
3412.2										X	X									
3413		X																		
3414		X																		
3415		X																		
3416		X																		
3417	X						X	X												
3417.1.2							X													
3417.1.3								X												
3417.3.2							X													
3417.3.3								X												
3418	X						X	X												
3419	X						X	X												
3420							X	X												
3421	X						X	X												
3422	X						X	X												
3423							X	X												
3424										X										

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

The state agency does not adopt sections identified with the following symbol: †

## CHAPTER 34

# EXISTING STRUCTURES

### SECTION 3401 GENERAL

**3401.1 Scope.** The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing structures, including state-regulated structures in accordance with Sections 3401.1 and 3401.2.

**[DSA-AC]** For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance for accessibility requirements, see Chapter 11B, Section 11B-202.

**Exception:** Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

**[HCD 1]** In addition to the requirements in this chapter, maintenance, alteration, repair, addition, or change of occupancy to existing buildings and accessory structures under the authority of the Department of Housing and Community Development, as provided in Section 1.8.2.1.1, shall comply with California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

#### Exceptions:

1. Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300-02.
2. **[HCD 2]** For moved buildings and maintenance, alteration, repair, addition, or change of occupancy to existing buildings and accessory structures in mobilehome parks or special occupancy parks as provided in Section 1.8.2.1.3. See California Code of Regulations, Title 25, Division 1, Chapters 2 and 2.2.
3. **[HCD 1]** Limited-density owner-built rural dwellings.

**3401.1.1 Existing state-owned structures.** The provisions of Sections 3417 through 3422 establish minimum standards for earthquake evaluation and design for retrofit of existing state-owned structures, including buildings owned by the University of California and the California State University.

The provisions of Sections 3417 through 3422 may be adopted by a local jurisdiction for earthquake evaluation and design for retrofit of existing buildings.

**3401.1.2 Public school buildings.** **[DSA-SS]** The provisions of Sections 3417 through 3423 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as public school buildings under the jurisdiction of the Division of the State Architect-Structural Safety (DSA-SS, refer to Section 1.9.2.1) where required by Sections 4-307 and 4-309(c) of the California Administrative Code.

The provisions of Section 3417 through 3423 also establish minimum standards for earthquake evaluation and

design for rehabilitation of existing public school buildings currently under the jurisdiction of DSA-SS.

**3401.1.3 Community college buildings.** **[DSA-SS/CC]** The provisions of Sections 3417 through 3423 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as community college buildings under the jurisdiction of the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC, refer to Section 1.9.2.2) where required by Sections 4-307 and 4-309(c) of the California Administrative Code.

The provisions of Section 3417 through 3423 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing community college buildings currently under the jurisdiction of DSA-SS/CC.

**3401.2 Maintenance.** Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or safeguards which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. To determine compliance with this subsection, the building official shall have the authority to require a building or structure to be reinspected. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures.

**3401.3 Compliance.** Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, in the California Fire Code, California Mechanical Code, California Plumbing Code, California Residential Code and California Electrical Code. Where provisions of the other codes conflict with provisions of this chapter, the provisions of this chapter shall take precedence.

**3401.4 Building materials and systems.** Building materials and systems shall comply with the requirements of this section.

**3401.4.1 Existing materials.** Materials already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the building code official to be unsafe per Section 116.

**[HCD 1]** Local ordinances or regulations shall permit the replacement, retention and extension of original materials, and the use of original methods of construction, for any building or accessory structure, provided such building or structure complied with the building code provisions in effect at the time of original construction and the building or accessory structure does not become or continue to be a substandard building. For additional information, see Health and Safety Code Sec-

tions 17912, 17920.3, 17922(d), 17922.3, 17958.8 and 17958.9.

**3401.4.2 New and replacement materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

**3401.4.3 Existing seismic force-resisting systems.** Where the existing seismic force-resisting system is a type that can be designated ordinary, values of  $R$ ,  $\Omega_0$ , and  $C_d$  for the existing seismic force-resisting system shall be those specified by this code for an ordinary system unless it is demonstrated that the existing system will provide performance equivalent to that of a detailed, intermediate or special system.

**3401.5 Dangerous conditions.** The building official shall have the authority to require the elimination of conditions deemed dangerous.

**3401.6 Alternative compliance.** Work performed in accordance with the *International Existing Building Code* shall be deemed to comply with the provisions of this chapter.

> **Exception:** [OSHPD 2] Section 3401.6 not permitted by OSHPD.

**3401.7 Adoption of ASCE 41:** [OSHPD 2 & 3] All additions, alterations, repairs and seismic retrofit to the existing structures or portions thereof may be designed in accordance with the provisions of ASCE 41, as modified herein. For load combinations which do not include seismic forces, the new building code provisions of this code shall be applicable.

**3401.7.1 ASCE 41 Section 1.4 – Rehabilitation Objectives.** Target building performance level shall be Life Safety (LS) Building Performance Level (3-C) as defined in Section 1.5.3.3 at Basic Safety Earthquake 1 (BSE-1) Seismic Hazard Level as defined in section 1.6.1.2 for Occupancy Category II Structures and Basic Safety Objective (BSO) Level as defined in Section 1.4.1 for Occupancy Category III Structures.

Risk Category IV structures shall satisfy Immediate Occupancy (IO) Building Performance Level of (1-B) as defined in Section 1.5.3.2 at Basic Safety Earthquake 1 (BSE-1) Seismic Hazard Level as defined in Section 1.6.1.2 and Collapse Prevention (CP) building performance level (5-E) per Section 1.5.3.4 at Basic Safety Earthquake 2 (BSE-2) Seismic Hazard Level as defined in Section 1.6.1.1.

**3401.7.2 ASCE 41 Section 1.6 - Seismic Hazard.** Response spectra and acceleration time histories shall be constructed in accordance with ASCE 7. The Basic Safety Earthquake 2 (BSE-2) in ASCE 41 shall be same as Maximum Considered Earthquake ( $MCE_R$ ) in ASCE 7. The Basic Safety Earthquake 1 (BSE-1) shall be two-thirds of BSE-2.

**3401.7.3 Analysis procedure.** The selection of a particular analysis procedure from ASCE 41 may be subject to the approval of the enforcement agent.

**3401.7.4 Structural design criteria.** Prior to implementation of ASCE 41 nonlinear dynamic procedures—the

ground motion, analysis and design methods, material assumptions and acceptance criteria proposed by the engineer shall be reviewed by the enforcement agent.

**3401.7.5 Structural observation, testing and inspections.** Construction, testing, inspection and structural observation requirements shall be as required for new construction.

**3401.8 Existing Group R Occupancies.** [SFM] See the California Residential Code for existing Group R-3 occupancies or Chapter 46 of the California Fire Code for all other existing Group R occupancies. <

**3401.9 Dangerous conditions.** [BSC] Regardless of the extent of structural or nonstructural damage, the building code official shall have the authority to require the elimination of conditions deemed dangerous.

## SECTION 3402 DEFINITIONS

**3402.1 Definitions.** The following terms are defined in Chapter 2:

**DANGEROUS.**

**EXISTING STRUCTURE.**

**PRIMARY FUNCTION.**

**SUBSTANTIAL STRUCTURAL DAMAGE.**

**TECHNICALLY INFEASIBLE.**

## SECTION 3403 ADDITIONS

**3403.1 General.** Additions to any building or structure shall comply with the requirements of this code for new construction. Alterations to the existing building or structure shall be made to ensure that the existing building or structure together with the addition are no less conforming with the provisions of this code than the existing building or structure was prior to the addition. An existing building together with its additions shall comply with the height and area provisions of Chapter 5.

**Exception:** For state-owned buildings, including those owned by the University of California and the California State University and the Judicial Council, the requirements of Sections 3403.3 and 3403.4 are replaced by the requirements of Sections 3417 through 3422.

**3403.2 Flood hazard areas.** For buildings and structures in flood hazard areas established in Section 1612.3, any addition that constitutes substantial improvement of the existing structure, as defined in Section 1612.2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612.3, any additions that do not constitute substantial improvement of the existing structure, as defined in Section 1612.2, are not required to comply with the flood design requirements for new construction.

**3403.3 Existing structural elements carrying gravity load.**

Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased shall be considered an altered element subject to the requirements of Section 3404.3. Any existing element that will form part of the lateral load path for any part of the addition shall be considered an existing lateral load-carrying structural element subject to the requirements of Section 3403.4.

**3403.3.1 Design live load.** Where the addition does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the addition. If the approved live load is less than that required by Section 1607, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the addition does result in increased design live load, the live load required by Section 1607 shall be used.

**3403.4 Existing structural elements carrying lateral load.**

Where the addition is structurally independent of the existing structure, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the addition is not structurally independent of the existing structure, the existing structure and its addition acting together as a single structure shall be shown to meet the requirements of Sections 1609 and 1613.

**Exception:** Any existing lateral load-carrying structural element whose demand-capacity ratio with the addition considered is no more than 10 percent greater than its demand-capacity ratio with the addition ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.

**3403.5 Smoke alarms in existing portions of a building.**

Where an addition is made to a building or structure of a Group R or I-1 occupancy, the existing building shall be provided with smoke alarms in accordance with Section 1103.8 of the *California Fire Code*.

## SECTION 3404 ALTERATIONS

**3404.1 General.** Except as provided by Section 3401.4 or this section, alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less complying with the provisions of this code than the existing building or structure was prior to the alteration.

**Exceptions:**

1. An existing stairway shall not be required to comply with the requirements of Section 1009 where the existing space and construction does not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with Section 1009.15 shall not be required to comply with the requirements of Section 1012.6 regarding full extension of the handrails where such extensions would be hazardous due to plan configuration.
3. *For state-owned buildings, including those owned by the University of California and the California State University and the Judicial Council, the requirements of Sections 3404.3 through 3404.5 are replaced by the requirements of Sections 3417 through 3422.*

**3404.1.1 Replacement, retention and extension of original materials.** [HCD 1] *Local ordinances or regulations shall permit the replacement, retention and extension of original materials, and the use of original methods of construction, for any building or accessory structure, provided such building or structure complied with the building code provisions in effect at the time of original construction and the building or accessory structure does not become or continue to be a substandard building. For additional information, see Health and Safety Code Sections 17912, 17920.3, 17922(d), 17922.3, 17958.8 and 17958.9.*

**3404.2 Flood hazard areas.** For buildings and structures in flood hazard areas established in Section 1612.3, any alteration that constitutes substantial improvement of the existing structure, as defined in Section 1612.2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612.3, any alterations that do not constitute substantial improvement of the existing structure, as defined in Section 1612.2, are not required to comply with the flood design requirements for new construction.

**3404.3 Existing structural elements carrying gravity load.**

Any existing gravity load-carrying structural element for which an alteration causes an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the alteration shall be shown to have the capacity to resist the applicable design gravity loads required by this code for new structures.

**3404.3.1 Design live load.** Where the alteration does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the alteration. If the approved live load is less than that required by Section 1607, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the alteration does



result in increased design live load, the live load required by Section 1607 shall be used.

#### 3404.4 Existing structural elements carrying lateral load.

Except as permitted by Section 3404.5, where the alteration increases design lateral loads in accordance with Section 1609 or 1613, or where the alteration results in a structural irregularity as defined in ASCE 7, or where the alteration decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall be shown to meet the requirements of Sections 1609 and 1613.

**Exception:** Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is no more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces per Sections 1609 and 1613. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces, and capacities shall account for the cumulative effects of additions and alterations since original construction.

**3404.5 Voluntary seismic improvements.** Alterations to existing structural elements or additions of new structural elements that are not otherwise required by this chapter and are initiated for the purpose of improving the performance of the seismic force-resisting system of an existing structure or the performance of seismic bracing or anchorage of existing nonstructural elements shall be permitted, provided that an engineering analysis is submitted demonstrating the following:

1. The altered structure and the altered nonstructural elements are no less conforming with the provisions of this code with respect to earthquake design than they were prior to the alteration.
2. New structural elements are detailed as required for new construction.
3. New or relocated nonstructural elements are detailed and connected to existing or new structural elements as required for new construction.
4. The alterations do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

**3404.6 Smoke alarms.** Individual sleeping units and individual dwelling units in Group R and I-1 occupancies shall be provided with smoke alarms in accordance with Section 1103.8 of the *California Fire Code*.

## SECTION 3405 REPAIRS

**3405.1 General.** Buildings and structures, and parts thereof, shall be repaired in compliance with Section 3405 and 3401.2. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the requirements for alterations in this chapter. Routine maintenance required by Section 3401.2, ordinary repairs exempt from permit in accordance with Section 105.2, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.

**Exception:** For state-owned buildings, including those owned by the University of California and the California State University and the Judicial Council, the requirements of Sections 3405.2 through 3405.4 are replaced by the requirements of Sections 3417 through 3422.

**3405.1.2 Replacement, retention and extension of original materials. [HCD 1]** Local ordinances or regulations shall permit the replacement, retention and extension of original materials, and the use of original methods of construction, for any building or accessory structure, provided such building or structure complied with the building code provisions in effect at the time of original construction and the building or accessory structure does not become or continue to be a substandard building. For additional information, see *Health and Safety Code* Sections 17912, 17920.3, 17922(d), 17922.3, 17958.8 and 17958.9.

**3405.2 Substantial structural damage to vertical elements of the lateral force-resisting system.** A building that has sustained substantial structural damage to the vertical elements of its lateral force-resisting system shall be evaluated and repaired in accordance with the applicable provisions of Sections 3405.2.1 through 3405.2.3.

#### Exceptions:

1. Buildings assigned to Seismic Design Category A, B, or C whose substantial structural damage was not caused by earthquake need not be evaluated or rehabilitated for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or rehabilitated for load combinations that include earthquake effects.

**3405.2.1 Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the building official. The evaluation shall establish whether the damaged building, if repaired to its pre-damage state, would comply with the provisions of this code for wind and earthquake loads.

Wind loads for this evaluation shall be those prescribed in Section 1609. Earthquake loads for this evaluation, if required, shall be permitted to be 75 percent of those prescribed in Section 1613.

**3405.2.2 Extent of repair for compliant buildings.** If the evaluation establishes compliance of the pre-damage building in accordance with Section 3405.2.1, then repairs shall be permitted that restore the building to its pre-damage state, based on material properties and design strengths applicable at the time of original construction.

**3405.2.3 Extent of repair for noncompliant buildings.** If the evaluation does not establish compliance of the pre-damage building in accordance with Section 3404.2.1, then the building shall be rehabilitated to comply with applicable provisions of this code for load combinations that include wind or seismic loads. The wind loads for the repair

shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be as required by this code. Earthquake loads for this rehabilitation design shall be those required for the design of the pre-damage building, but not less than 75 percent of those prescribed in Section 1613. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

**3405.3 Substantial structural damage to gravity load-carrying components.** Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions of this code for dead and live loads. Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects. Existing gravity load-carrying structural elements shall be permitted to be designed for live loads approved prior to the damage. Nondamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated or shown to have the capacity to carry the design loads of the rehabilitation design. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

**3405.3.1 Lateral force-resisting elements.** Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to gravity load-carrying components was caused primarily by wind or earthquake effects, then the building shall be evaluated in accordance with Section 3405.2.1 and, if noncompliant, rehabilitated in accordance with Section 3405.2.3.

#### Exceptions:

1. One- and two-family dwellings need not be evaluated or rehabilitated for load combinations that include earthquake effects.
2. Buildings assigned to Seismic Design Category A, B, or C whose substantial structural damage was not caused by earthquake need not be evaluated or rehabilitated for load combinations that include earthquake effects.

**3405.4 Less than substantial structural damage.** For damage less than substantial structural damage, repairs shall be allowed that restore the building to its pre-damage state, based on material properties and design strengths applicable at the time of original construction. New structural members and connections used for this repair shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

**3405.5 Flood hazard areas.** For buildings and structures in flood hazard areas established in Section 1612.3, any repair that constitutes substantial improvement of the existing structure, as defined in Section 1612.2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612.3, any repairs that do not constitute substantial improvement or repair of substantial damage of the existing structure, as defined in Section 1612.2, are not required to comply with the flood design requirements for new construction.

## SECTION 3406 FIRE ESCAPES

**3406.1 Where permitted.** Fire escapes shall be permitted only as provided for in Sections 3406.1.1 through 3406.1.4.

**3406.1.1 New buildings.** Fire escapes shall not constitute any part of the required means of egress in new buildings.

**3406.1.2 Existing fire escapes.** Existing fire escapes shall be continued to be accepted as a component in the means of egress in existing buildings only.

**3406.1.3 New fire escapes.** New fire escapes for existing buildings shall be permitted only where exterior stairs cannot be utilized due to lot lines limiting stair size or due to the sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

**3406.1.4 Limitations.** Fire escapes shall comply with this section and shall not constitute more than 50 percent of the required number of exits nor more than 50 percent of the required *exit* capacity.

**3406.2 Location.** Where located on the front of the building and where projecting beyond the building line, the lowest landing shall not be less than 7 feet (2134 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counter-balanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall not be less than 12 feet (3658 mm).

**3406.3 Construction.** The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other approved noncombustible materials. Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Type III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.

**3406.4 Dimensions.** Stairs shall be at least 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm) and landings at the foot of stairs not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than 8 inches (203 mm) below the door.

**3406.5 Opening protectives.** Doors and windows along the fire escape shall be protected with  $\frac{3}{4}$ -hour opening protectives.

## SECTION 3407 GLASS REPLACEMENT

**3407.1 Conformance.** The installation or replacement of glass shall be as required for new installations.

## SECTION 3408 CHANGE OF OCCUPANCY

**3408.1 Conformance.** No change shall be made in the use or occupancy of any building that would place the building in a different division of the same group of occupancies or in a different group of occupancies, unless such building is made to comply with the requirements of this code for such division or group of occupancies. Subject to the approval of the building official, the use or occupancy of existing buildings shall be permitted to be changed and the building is allowed to be occupied for purposes in other groups without conforming to all the requirements of this code for those groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

**3408.2 Certificate of occupancy.** A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met.

**3408.3 Stairways.** Existing stairways in an existing structure shall not be required to comply with the requirements of a new stairway as outlined in Section 1009 where the existing space and construction will not allow a reduction in pitch or slope.

**3408.4 Seismic.** When a change of occupancy results in a structure being reclassified to a higher risk category, the structure shall conform to the seismic requirements for a new structure of the higher risk category.

### Exceptions:

1. Specific seismic detailing requirements of Section 1613 for a new structure shall not be required to be met where the seismic performance is shown to be equivalent to that of a new structure. A demonstration of equivalence shall consider the regularity, overstrength, redundancy and ductility of the structure.
2. When a change of use results in a structure being reclassified from Risk Category I or II to Risk Category III and the structure is located where the seismic coefficient,  $S_{DS}$ , is less than 0.33, compliance with the seismic requirements of Section 1613 are not required.

## SECTION 3409 HISTORIC BUILDINGS

*[DSA-AC] For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance for Qualified Historical Buildings, see California Code of Regulations, Title 24, Part 8 (California Historical Building Code).*

**3409.1 Historic buildings.** The provisions of this code relating to the construction, repair, alteration, addition, restoration and movement of structures, and change of occupancy shall not be mandatory for historic buildings where such buildings are judged by the building official to not constitute a distinct life safety hazard.

**3409.2 Flood hazard areas.** Within flood hazard areas established in accordance with Section 1612.3, where the work pro-

posed constitutes substantial improvement as defined in Section 1612.2, the building shall be brought into compliance with Section 1612.

**Exception:** Historic buildings that are:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places;
2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district; or
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

## SECTION 3410 MOVED STRUCTURES

**3410.1 Conformance.** Structures moved into or within the jurisdiction shall comply with the provisions of this code for new structures.

**Exception:** *[HCD 1 & HCD 2] After July 1, 1978, local ordinances or regulations for moved apartment houses and dwellings shall permit the retention of existing materials and methods of construction, provided the apartment house or dwelling complies with the building standards for foundations applicable to new construction and does not become or continue to be a substandard building. For additional information, see Health and Safety Code Section 17958.9.*

## SECTION 3411 ACCESSIBILITY FOR EXISTING BUILDINGS

**3411.1 Scope.** The provisions of Sections 3411.1 through 3411.9 apply to maintenance, change of occupancy, additions and alterations to existing buildings, including those identified as historic buildings.

**3411.2 Maintenance of facilities.** A facility that is constructed or altered to be accessible shall be maintained accessible during occupancy.

**3411.3 Extent of application.** An alteration of an existing facility shall not impose a requirement for greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

**3411.4 Change of occupancy.** Existing buildings that undergo a change of group or occupancy shall comply with this section.

**Exception:** Type B dwelling units or sleeping units required by Section 1107 of this code are not required to be provided in existing buildings and facilities undergoing a change of occupancy in conjunction with alterations where the work



area is 50 percent or less of the aggregate area of the building.

**3411.4.1 Partial change in occupancy.** Where a portion of the building is changed to a new occupancy classification, any alterations shall comply with Sections 3411.6, 3411.7 and 3411.8.

**3411.4.2 Complete change of occupancy.** Where an entire building undergoes a change of occupancy, it shall comply with Section 3411.4.1 and shall have all of the following accessible features:

1. At least one accessible building entrance.
2. At least one accessible route from an accessible building entrance to primary function areas.
3. Signage complying with *Chapter 11A or 11B as applicable*.
4. Accessible parking, where parking is being provided.
5. At least one accessible passenger loading zone, when loading zones are provided.
6. At least one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.

Where it is technically infeasible to comply with the new construction standards for any of these requirements for a change of group or occupancy, the above items shall conform to the requirements to the maximum extent technically feasible.

**Exception:** The accessible features listed in Items 1 through 6 are not required for an accessible route to Type B units.

**3411.5 Additions.** Provisions for new construction shall apply to additions. An addition that affects the accessibility to, or contains an area of, a primary function shall comply with the requirements in Section 3411.7.

**3411.6 Alterations.** A facility that is altered shall comply with the applicable provisions in *Chapter 11A or 11B as applicable* of this code and ICC A117.1, unless technically infeasible. Where compliance with this section is technically infeasible, the alteration shall provide access to the maximum extent technically feasible.

**Exceptions:**

1. The altered element or space is not required to be on an accessible route, unless required by Section 3411.7.
2. Accessible means of egress required by Chapter 10 are not required to be provided in existing buildings and facilities.
3. The alteration to Type A individually owned dwelling units within a Group R-2 occupancy shall meet the provision for a Type B dwelling unit and shall comply with the applicable provisions in *Chapter 11A or 11B as applicable*.
4. Type B dwelling or sleeping units required by Section 1107 of this code are not required to be provided in existing buildings and facilities undergoing a change

of occupancy in conjunction with alterations where the work area is 50 percent or less of the aggregate area of the building.

**3411.7 Alterations affecting an area containing a primary function.** Where an alteration affects the accessibility to, or contains an area of primary function, the route to the primary function area shall be accessible. The accessible route to the primary function area shall include toilet facilities or drinking fountains serving the area of primary function.

**Exceptions:**

1. The costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of primary function.
2. This provision does not apply to alterations limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to alterations limited solely to mechanical systems, electrical systems, installation or alteration of fire protection systems and abatement of hazardous materials.
4. This provision does not apply to alterations undertaken for the primary purpose of increasing the accessibility of an existing building, facility or element.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

**3411.8 Scoping for alterations.** The provisions of Sections 3411.8.1 through 3411.8.14 shall apply to alterations to existing buildings and facilities.

**3411.8.1 Entrances.** Accessible entrances shall be provided in accordance with *Chapter 11A or 11B as applicable*.

**Exception:** Where an alteration includes alterations to an entrance, and the building or facility has an accessible entrance, the altered entrance is not required to be accessible, unless required by Section 3411.7. Signs complying with *Chapter 11A or 11B as applicable* shall be provided.

**3411.8.2 Elevators.** Altered elements of existing elevators shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* and ICC A117.1. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

**3411.8.3 Platform lifts.** Platform (wheelchair) lifts complying with ICC A117.1 and installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

**3411.8.4 Stairs and escalators in existing buildings.** In alterations, change of occupancy or additions where an escalator or stair is added where none existed previously and major structural modifications are necessary for installation, an accessible route shall be provided between the levels served by the escalator or stairs in accordance with *Chapter 11A or 11B as applicable*.



**3411.8.5 Ramps.** Where slopes steeper than allowed by Section 1010.2 are necessitated by space limitations, the slope of ramps in or providing access to existing buildings or facilities shall comply with Table 3411.8.5.

**TABLE 3411.8.5  
RAMPS**

SLOPE	MAXIMUM RISE
Steeper than 1:10 but not steeper than 1:8	3 inches
Steeper than 1:12 but not steeper than 1:10	6 inches

For SI: 1 inch = 25.4 mm.

**3411.8.6 Performance areas.** Where it is technically infeasible to alter performance areas to be on an accessible route, at least one of each type of performance area shall be made accessible.

**3411.8.7 Accessible dwelling or sleeping units.** Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added, the requirements of *Chapter 11A or 11B as applicable* for Accessible units apply only to the quantity of spaces being altered or added.

**3411.8.8 Type A dwelling or sleeping units.** Where more than 20 Group R-2 dwelling or sleeping units are being altered or added, the requirements of *Chapter 11A or 11B as applicable* for Type A units apply only to the quantity of the spaces being altered or added.

**3411.8.9 Type B dwelling or sleeping units.** Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements of *Chapter 11A or 11B as applicable* for Type B units apply only to the quantity of the spaces being added. Where Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered and where the work area is greater than 50 percent of the aggregate area of the building, the requirements of Section 1107 for Type B units apply only to the quantity of the spaces being altered.

**3411.8.10 Jury boxes and witness stands.** In alterations, accessible wheelchair spaces are not required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where the ramp or lift access restricts or projects into the means of egress.

**3411.8.11 Toilet rooms.** Where it is technically infeasible to alter existing toilet and bathing rooms to be accessible, an accessible family or assisted-use toilet or bathing rooms constructed in accordance with *Chapter 11A or 11B as applicable* is permitted. The family or assisted-use toilet or bathing room shall be located on the same floor and in the same area as the existing toilet or bathing rooms.

**3411.8.12 Dressing, fitting and locker rooms.** Where it is technically infeasible to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level shall be provided. Where separate-sex facilities are provided, accessible rooms for each sex shall be provided. Separate-sex facilities are not required where only unisex rooms are provided.

**3411.8.13 Fuel dispensers.** Operable parts of replacement fuel dispensers shall be permitted to be 54 inches (1370 mm) maximum measured from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

**3411.8.14 Thresholds.** The maximum height of thresholds at doorways shall be  $\frac{3}{4}$  inch (19.1 mm). Such thresholds shall have beveled edges on each side.

**3411.9 Historic buildings.** These provisions shall apply to facilities designated as historic structures that undergo alterations or a change of occupancy, unless technically infeasible. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the facility, as determined by the applicable governing authority, the alternative requirements of Sections 3411.9.1 through 3411.9.4 for that element shall be permitted.

**Exception:** Type B dwelling or sleeping units required by Section 1107 are not required to be provided in historical buildings.

**3411.9.1 Site arrival points.** At least one accessible route from a site arrival point to an accessible entrance shall be provided.

**3411.9.2 Multilevel buildings and facilities.** An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

**3411.9.3 Entrances.** At least one main entrance shall be accessible.

**Exceptions:**

1. If a main entrance cannot be made accessible, an accessible nonpublic entrance that is unlocked while the building is occupied shall be provided; or
2. If a main entrance cannot be made accessible, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with *Chapter 11A or 11B as applicable* shall be provided at the primary entrance and the accessible entrance.

**3411.9.4 Toilet and bathing facilities.** Where toilet rooms are provided, at least one accessible family or assisted-use toilet room complying with *Chapter 11A or 11B as applicable* shall be provided.

## SECTION 3412 COMPLIANCE ALTERNATIVES

**3412.1 Compliance.** The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings while permitting repair, alteration, addition and change of occupancy without requiring full compliance with Chapters 2 through 33, or Sections 3401.3, and 3403 through 3409, except where compliance with other provisions of this code is specifically required in this section.

**3412.2 Applicability.** Structures existing prior to *January 1, 2014*, in which there is work involving additions, alterations or changes of occupancy shall be made to comply with the

requirements of this section or the provisions of Sections 3403 through 3409. The provisions in Sections 3412.2.1 through 3412.2.5 shall apply to existing occupancies that will continue to be, or are proposed to be, in Groups A, B, E, F, M, R, S and U. These provisions shall not apply to buildings with occupancies in Group H or I.

**3412.2.1 Change in occupancy.** Where an existing building is changed to a new occupancy classification and this section is applicable, the provisions of this section for the new occupancy shall be used to determine compliance with this code.

**3412.2.2 Partial change in occupancy.** Where a portion of the building is changed to a new occupancy classification, and that portion is separated from the remainder of the building with fire barriers or horizontal assemblies having a fire-resistance rating as required by Table 508.4 for the separate occupancies, or with approved compliance alternatives, the portion changed shall be made to comply with the provisions of this section.

Where a portion of the building is changed to a new occupancy classification, and that portion is not separated from the remainder of the building with fire barriers or horizontal assemblies having a fire-resistance rating as required by Table 508.4 for the separate occupancies, or with approved compliance alternatives, the provisions of this section which apply to each occupancy shall apply to the entire building. Where there are conflicting provisions, those requirements which secure the greater public safety shall apply to the entire building or structure.

**3412.2.3 Additions.** Additions to existing buildings shall comply with the requirements of this code for new construction. The combined height and area of the existing building and the new addition shall not exceed the height and area allowed by Chapter 5. Where a fire wall that complies with Section 706 is provided between the addition and the existing building, the addition shall be considered a separate building.

**3412.2.4 Alterations and repairs.** An existing building or portion thereof, which does not comply with the requirements of this code for new construction, shall not be altered or repaired in such a manner that results in the building being less safe or sanitary than such building is currently. If, in the alteration or repair, the current level of safety or sanitation is to be reduced, the portion altered or repaired shall conform to the requirements of Chapters 2 through 12 and Chapters 14 through 33.

**3412.2.4.1 Flood hazard areas.** For existing buildings located in flood hazard areas established in Section 1612.3, if the alterations and repairs constitute substantial improvement of the existing building, the existing building shall be brought into compliance with the requirements for new construction for flood design.

**3412.2.5 Accessibility requirements.** All portions of the buildings proposed for change of occupancy shall conform to the accessibility provisions of Section 3411.

**3412.3 Acceptance.** For repairs, alterations, additions and changes of occupancy to existing buildings that are evaluated

in accordance with this section, compliance with this section shall be accepted by the building official.

**3412.3.1 Hazards.** Where the building official determines that an unsafe condition exists, as provided for in Section 116, such unsafe condition shall be abated in accordance with Section 116.

**3412.3.2 Compliance with other codes.** Buildings that are evaluated in accordance with this section shall comply with the *California Fire Code* and the *California Property Maintenance Code*.

**3412.4 Investigation and evaluation.** For proposed work covered by this section, the building owner shall cause the existing building to be investigated and evaluated in accordance with the provisions of this section.

**3412.4.1 Structural analysis.** The owner shall have a structural analysis of the existing building made to determine adequacy of structural systems for the proposed alteration, addition or change of occupancy. The analysis shall demonstrate that the building with the work completed is capable of resisting the loads specified in Chapter 16.

**3412.4.2 Submittal.** The results of the investigation and evaluation as required in Section 3412.4, along with proposed compliance alternatives, shall be submitted to the building official.

**3412.4.3 Determination of compliance.** The building official shall determine whether the existing building, with the proposed addition, alteration or change of occupancy, complies with the provisions of this section in accordance with the evaluation process in Sections 3412.5 through 3412.9.

**3412.5 Evaluation.** The evaluation shall be comprised of three categories: fire safety, means of egress and general safety, as defined in Sections 3412.5.1 through 3412.5.3.

**3412.5.1 Fire safety.** Included within the fire safety category are the structural fire resistance, automatic fire detection, fire alarm, automatic sprinkler system and fire suppression system features of the facility.

**3412.5.2 Means of egress.** Included within the means of egress category are the configuration, characteristics and support features for means of egress in the facility.

**3412.5.3 General safety.** Included within the general safety category are the fire safety parameters and the means of egress parameters.

**3412.6 Evaluation process.** The evaluation process specified herein shall be followed in its entirety to evaluate existing buildings. Table 3412.7 shall be utilized for tabulating the results of the evaluation. References to other sections of this code indicate that compliance with those sections is required in order to gain credit in the evaluation herein outlined. In applying this section to a building with mixed occupancies, where the separation between the mixed occupancies does not qualify for any category indicated in Section 3412.6.16, the score for each occupancy shall be determined and the lower score determined for each section of the evaluation process shall apply to the entire building.

Where the separation between mixed occupancies qualifies for any category indicated in Section 3412.6.16, the score for

each occupancy shall apply to each portion of the building based on the occupancy of the space.

**3412.6.1 Building height.** The value for building height shall be the lesser value determined by the formula in Section 3412.6.1.1. Chapter 5 shall be used to determine the allowable height of the building, including allowable increases due to automatic sprinklers as provided for in Section 504.2. Subtract the actual building height in feet from the allowable and divide by 12 1/2 feet. Enter the height value and its sign (positive or negative) in Table 3412.7 under Safety Parameter 3412.6.1, Building Height, for fire safety, means of egress and general safety. The maximum score for a building shall be 10.

**3412.6.1.1 Height formula.** The following formulas shall be used in computing the building height value.

$$\text{Height value, feet} = \frac{(AH) - (EBH)}{12.5} \times CF \quad (\text{Equation 34-1})$$

$$\text{Height value, stories} = (AS - EBS) \times CF \quad (\text{Equation 34-2})$$

where:

*AH* = Allowable height in feet from Table 503.

*EBH* = Existing building height in feet.

*AS* = Allowable height in stories from Table 503.

*EBS* = Existing building height in stories.

*CF* = 1 if  $(AH) - (EBH)$  is positive.

*CF* = Construction-type factor shown in Table 3412.6.6(2) if  $(AH) - (EBH)$  is negative.

**Note:** Where mixed occupancies are separated and individually evaluated as indicated in Section 3412.6, the values *AH*, *AS*, *EBH* and *EBS* shall be based on the height of the occupancy being evaluated.

**3412.6.2 Building area.** The value for building area shall be determined by the formula in Section 3412.6.2.2. Section 503 and the formula in Section 3412.6.2.1 shall be used to determine the allowable area of the building. This shall include any allowable increases due to frontage and automatic sprinklers as provided for in Section 506. Subtract the actual building area in square feet from the allowable area and divide by 1,200 square feet. Enter the area value and its sign (positive or negative) in Table 3412.7 under Safety Parameter 3412.6.2, Building Area, for fire safety, means of egress and general safety. In determining the area value, the maximum permitted positive value for area is 50 percent of the fire safety score as listed in Table 3412.8, Mandatory Safety Scores.

**3412.6.2.1 Allowable area formula.** The following formula shall be used in computing allowable area:

$$A_a = [A_t + (A_t \times I_s) + (A_t \times I_f)] \quad (\text{Equation 34-3})$$

where:

*A<sub>a</sub>* = Allowable building area per story (square feet).

*A<sub>t</sub>* = Tabular building area per story in accordance with Table 503 (square feet)

*I<sub>s</sub>* = Area increase factor due to sprinkler protection as calculated in accordance with Section 506.3.

*I<sub>f</sub>* = Area increase factor due to for frontage as calculated in accordance with Section 506.2.

**3412.6.2.2 Area formula.** The following formula shall be used in computing the area value. Determine the area value for each occupancy floor area on a floor-by-floor basis. For each occupancy, choose the minimum area value of the set of values obtained for the particular occupancy.

$$\text{Area value } i = \frac{\text{Allowable area } i}{1,200 \text{ square feet}} \left[ 1 - \left( \frac{\text{Actual area } i}{\text{Allowable area } i} + \dots + \frac{\text{Actual area } n}{\text{Allowable area } n} \right) \right] \quad (\text{Equation 34-4})$$

where:

*i* = Value for an individual separated occupancy on a floor.

*n* = Number of separated occupancies on a floor.

**3412.6.3 Compartmentation.** Evaluate the compartments created by fire barriers or horizontal assemblies which comply with Sections 3412.6.3.1 and 3412.6.3.2 and which are exclusive of the wall elements considered under Sections 3412.6.4 and 3412.6.5. Conforming compartments shall be figured as the net area and do not include shafts, chases, stairways, walls or columns. Using Table 3412.6.3, determine the appropriate compartmentation value (*CV*) and enter that value into Table 3412.7 under Safety Parameter 3412.6.3, Compartmentation, for fire safety, means of egress and general safety.

**3412.6.3.1 Wall construction.** A wall used to create separate compartments shall be a fire barrier conforming to Section 707 with a fire-resistance rating of not less than 2 hours. Where the building is not divided into more than one compartment, the compartment size shall be taken as the total floor area on all floors. Where there is more than one compartment within a story, each compartmented area on such story shall be provided with a horizontal exit conforming to Section 1025. The fire door serving as the horizontal exit between compartments shall be so installed, fitted and gasketed that such fire door will provide a substantial barrier to the passage of smoke.

**3412.6.3.2 Floor/ceiling construction.** A floor/ceiling assembly used to create compartments shall conform to Section 712 and shall have a fire-resistance rating of not less than 2 hours.

**TABLE 3412.6.3  
COMPARTMENTATION VALUES**

OCCUPANCY	CATEGORIES <sup>a</sup>				
	a Compartment size equal to or greater than 15,000 square feet	b Compartment size of 10,000 square feet	c Compartment size of 7,500 square feet	d Compartment size of 5,000 square feet	e Compartment size of 2,500 square feet or less
A-1, A-3	0	6	10	14	18
A-2	0	4	10	14	18
A-4, B, E, S-2	0	5	10	15	20
F, M, R, S-1	0	4	10	16	22

For SI: 1 square foot = 0.093 m<sup>2</sup>.

a. For areas between categories, the compartmentation value shall be obtained by linear interpolation.

**3412.6.4 Tenant and dwelling unit separations.** Evaluate the fire-resistance rating of floors and walls separating tenants, including dwelling units, and not evaluated under Sections 3412.6.3 and 3412.6.5. Under the categories and occupancies in Table 3412.6.4, determine the appropriate value and enter that value in Table 3412.7 under Safety Parameter 3412.6.4, Tenant and Dwelling Unit Separations, for fire safety, means of egress and general safety.

**TABLE 3412.6.4  
SEPARATION VALUES**

OCCUPANCY	CATEGORIES				
	a	b	c	d	e
A-1	0	0	0	0	1
A-2	-5	-3	0	1	3
A-3, A-4, B, E, F, M, S-1	-4	-3	0	2	4
R	-4	-2	0	2	4
S-2	-5	-2	0	2	4

**3412.6.4.1 Categories.** The categories for tenant and dwelling unit separations are:

1. Category a—No fire partitions; incomplete fire partitions; no doors; doors not self-closing or automatic-closing.
2. Category b—Fire partitions or floor assemblies with less than a 1-hour fire-resistance rating or not constructed in accordance with Sections 708 or 711.
3. Category c—Fire partitions with a 1-hour or greater fire-resistance rating constructed in accordance with Section 708 and floor assemblies with a 1-hour but less than 2-hour fire-resistance rating constructed in accordance with Section 711, or with only one tenant within the floor area.
4. Category d—Fire barriers with a 1-hour but less than 2-hour fire-resistance rating constructed in accordance with Section 707 and floor assemblies with a 2-hour or greater fire-resistance rating constructed in accordance with Section 711.
5. Category e—Fire barriers and floor assemblies with a 2-hour or greater fire-resistance rating and constructed in accordance with Sections 707 and 711, respectively.

**3412.6.5 Corridor walls.** Evaluate the fire-resistance rating and degree of completeness of walls which create corridors serving the floor, and constructed in accordance with Section 1018. This evaluation shall not include the wall elements considered under Sections 3412.6.3 and 3412.6.4. Under the categories and groups in Table 3412.6.5, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.5, Corridor Walls, for fire safety, means of egress and general safety.

**TABLE 3412.6.5  
CORRIDOR WALL VALUES**

OCCUPANCY	CATEGORIES			
	a	b	c <sup>a</sup>	d <sup>a</sup>
A-1	-10	-4	0	2
A-2	-30	-12	0	2
A-3, F, M, R, S-1	-7	-3	0	2
A-4, B, E, S-2	-5	-2	0	5

a. Corridors not providing at least one-half the travel distance for all occupants on a floor shall use Category b.

**3412.6.5.1 Categories.** The categories for Corridor Walls are:

1. Category a—No fire partitions; incomplete fire partitions; no doors; or doors not self-closing.
2. Category b—Less than 1-hour fire-resistance rating or not constructed in accordance with Section 708.4.
3. Category c—1-hour to less than 2-hour fire-resistance rating, with doors conforming to Section 716 or without corridors as permitted by Section 1018.
4. Category d—2-hour or greater fire-resistance rating, with doors conforming to Section 716.

**3412.6.6 Vertical openings.** Evaluate the fire-resistance rating of exit enclosures, hoistways, escalator openings and other shaft enclosures within the building, and openings between two or more floors. Table 3412.6.6(1) contains the appropriate protection values. Multiply that value by the construction type factor found in Table 3412.6.6(2). Enter the vertical opening value and its sign (positive or negative) in Table 3412.7 under Safety Parameter 3412.6.6, Vertical



Openings, for fire safety, means of egress, and general safety. If the structure is a one-story building or if all the unenclosed vertical openings within the building conform to the requirements of Section 708, enter a value of 2. The maximum positive value for this requirement shall be 2.

**3412.6.6.1 Vertical opening formula.** The following formula shall be used in computing vertical opening value.

$$VO = PV \times CF \quad (\text{Equation 34-5})$$

VO = Vertical opening value.

PV = Protection value [Table 3412.6.6(1)].

CF = Construction type factor [Table 3412.6.6(2)].

**TABLE 3412.6.6(1)  
VERTICAL OPENING PROTECTION VALUE**

PROTECTION	VALUE
None (unprotected opening)	-2 times number floors connected
Less than 1 hour	-1 times number floors connected
1 to less than 2 hours	1
2 hours or more	2

**TABLE 3412.6.6(2)  
CONSTRUCTION-TYPE FACTOR**

FACTOR	TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
	1.2	1.5	2.2	3.5	2.5	3.5	2.3	3.3	7

**3412.6.7 HVAC systems.** Evaluate the ability of the HVAC system to resist the movement of smoke and fire beyond the point of origin. Under the categories in Section 3412.6.7.1, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.7, HVAC Systems, for fire safety, means of egress and general safety.

**3412.6.7.1 Categories.** The categories for HVAC systems are:

1. Category a—Plenums not in accordance with Section 602 of the *California Mechanical Code*. -10 points.
2. Category b—Air movement in egress elements not in accordance with Section 1018.5. -5 points.
3. Category c—Both categories a and b are applicable. -15 points.
4. Category d—Compliance of the HVAC system with Section 1018.5 and Section 602 of the *California Mechanical Code*. 0 points.
5. Category e—Systems serving one story; or a central boiler/chiller system without ductwork connecting two or more stories. 5 points.

**3412.6.8 Automatic fire detection.** Evaluate the smoke detection capability based on the location and operation of automatic fire detectors in accordance with Section 907 and the *California Mechanical Code*. Under the categories and

occupancies in Table 3412.6.8, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.8, Automatic Fire Detection, for fire safety, means of egress and general safety.

**TABLE 3412.6.8  
AUTOMATIC FIRE DETECTION VALUES**

OCCUPANCY	CATEGORIES				
	a	b	c	d	e
A-1, A-3, F, M, R, S-1	-10	-5	0	2	6
A-2	-25	-5	0	5	9
A-4, B, E, S-2	-4	-2	0	4	8

**3412.6.8.1 Categories.** The categories for automatic fire detection are:

1. Category a—None.
2. Category b—Existing smoke detectors in HVAC systems and maintained in accordance with the *California Fire Code*.
3. Category c—Smoke detectors in HVAC systems. The detectors are installed in accordance with the requirements for new buildings in the *California Mechanical Code*.
4. Category d—Smoke detectors throughout all floor areas other than individual sleeping units, tenant spaces and dwelling units.
5. Category e—Smoke detectors installed throughout the floor area.

**3412.6.9 Fire alarm systems.** Evaluate the capability of the fire alarm system in accordance with Section 907. Under the categories and occupancies in Table 3412.6.9, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.9, Fire Alarm Systems, for fire safety, means of egress and general safety.

**TABLE 3412.6.9  
FIRE ALARM SYSTEM VALUES**

OCCUPANCY	CATEGORIES			
	a	b <sup>a</sup>	c	d
A-1, A-2, A-3, A-4, B, E, R	-10	-5	0	5
F, M, S	0	5	10	15

a. For buildings equipped throughout with an automatic sprinkler system, add 2 points for activation by a sprinkler waterflow device.

**3412.6.9.1 Categories.** The categories for fire alarm systems are:

1. Category a—None.
2. Category b—Fire alarm system with manual fire alarm boxes in accordance with Section 907.4 and alarm notification appliances in accordance with Section 907.5.2.
3. Category c—Fire alarm system in accordance with Section 907.
4. Category d—Category c plus a required emergency voice/alarm communications system and a

fire command center that conforms to Section 403.4.5 and contains the emergency voice/alarm communications system controls, fire department communication system controls and any other controls specified in Section 911 where those systems are provided.

**3412.6.10 Smoke control.** Evaluate the ability of a natural or mechanical venting, exhaust or pressurization system to control the movement of smoke from a fire. Under the categories and occupancies in Table 3412.6.10, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.10, Smoke Control, for means of egress and general safety.

**TABLE 3412.6.10  
SMOKE CONTROL VALUES**

OCCUPANCY	CATEGORIES					
	a	b	c	d	e	f
A-1, A-2, A-3	0	1	2	3	6	6
A-4, E	0	0	0	1	3	5
B, M, R	0	2 <sup>a</sup>	3 <sup>a</sup>	3 <sup>a</sup>	3 <sup>a</sup>	4 <sup>a</sup>
F, S	0	2 <sup>a</sup>	2 <sup>a</sup>	3 <sup>a</sup>	3 <sup>a</sup>	3 <sup>a</sup>

a. This value shall be 0 if compliance with Category d or e in Section 3412.6.8.1 has not been obtained.

**3412.6.10.1 Categories.** The categories for smoke control are:

1. Category a—None.
2. Category b—The building is equipped throughout with an automatic sprinkler system. Openings are provided in exterior walls at the rate of 20 square feet (1.86 m<sup>2</sup>) per 50 linear feet (15 240 mm) of exterior wall in each story and distributed around the building perimeter at intervals not exceeding 50 feet (15 240 mm). Such openings shall be readily openable from the inside without a key or separate tool and shall be provided with ready access thereto. In lieu of operable openings, clearly and permanently marked tempered glass panels shall be used.
3. Category c—One enclosed exit stairway, with ready access thereto, from each occupied floor of the building. The stairway has operable exterior windows and the building has openings in accordance with Category b.
4. Category d—One smokeproof enclosure and the building has openings in accordance with Category b.
5. Category e—The building is equipped throughout with an automatic sprinkler system. Each floor area is provided with a mechanical air-handling system designed to accomplish smoke containment. Return and exhaust air shall be moved directly to the outside without recirculation to other floor areas of the building under fire conditions. The system shall exhaust not less than six air changes per hour from the floor area. Supply air by mechanical means to the floor area is not required.

Containment of smoke shall be considered as confining smoke to the fire area involved without migration to other floor areas. Any other tested and approved design which will adequately accomplish smoke containment is permitted.

6. Category f—Each stairway shall be one of the following: a smokeproof enclosure in accordance with Section 1022.9; pressurized in accordance with Section 909.20.5 or shall have operable exterior windows.

**3412.6.11 Means of egress capacity and number.** Evaluate the means of egress capacity and the number of exits available to the building occupants. In applying this section, the means of egress are required to conform to the following sections of this code: 1003.7, 1004, 1005, 1014.2, 1014.3, 1015.2, 1021, 1024.1, 1027.2, 1027.5, 1028.2, 1028.3, 1028.4 and 1029. The number of exits credited is the number that is available to each occupant of the area being evaluated. Existing fire escapes shall be accepted as a component in the means of egress when conforming to Section 3406.

Under the categories and occupancies in Table 3412.6.11, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.11, Means of Egress Capacity, for means of egress and general safety.

**TABLE 3412.6.11  
MEANS OF EGRESS VALUES**

OCCUPANCY	CATEGORIES				
	a <sup>a</sup>	b	c	d	e
A-1, A-2, A-3, A-4, E	-10	0	2	8	10
B, F, S	-1	0	0	0	0
M	-3	0	1	2	4
R	-3	0	0	0	0

a. The values indicated are for buildings six stories or less in height. For buildings over six stories above grade plane, add an additional -10 points.

**3412.6.11.1 Categories.** The categories for Means of Egress Capacity and number of exits are:

1. Category a—Compliance with the minimum required means of egress capacity or number of exits is achieved through the use of a fire escape in accordance with Section 3406.
2. Category b—Capacity of the means of egress complies with Section 1004 and the number of exits complies with the minimum number required by Section 1021.
3. Category c—Capacity of the means of egress is equal to or exceeds 125 percent of the required means of egress capacity, the means of egress complies with the minimum required width dimensions specified in the code and the number of exits complies with the minimum number required by Section 1021.
4. Category d—The number of exits provided exceeds the number of exits required by Section

1021. Exits shall be located a distance apart from each other equal to not less than that specified in Section 1015.2.

5. Category e—The area being evaluated meets both Categories c and d.

**3412.6.12 Dead ends.** In spaces required to be served by more than one means of egress, evaluate the length of the exit access travel path in which the building occupants are confined to a single path of travel. Under the categories and occupancies in Table 3412.6.12, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.12, Dead Ends, for means of egress and general safety.

**TABLE 3412.6.12  
DEAD-END VALUES**

OCCUPANCY	CATEGORIES <sup>a</sup>		
	a	b	c
A-1, A-3, A-4, B, E, F, M, R, S	-2	0	2
A-2, E	-2	0	2

a. For dead-end distances between categories, the dead-end value shall be obtained by linear interpolation.

**3412.6.12.1 Categories.** The categories for dead ends are:

1. Category a—Dead end of 35 feet (10 670 mm) in nonsprinklered buildings or 70 feet (21 340 mm) in sprinklered buildings.
2. Category b—Dead end of 20 feet (6096 mm); or 50 feet (15 240 mm) in Group B in accordance with Section 1018.4, exception 2.
3. Category c — No dead ends; or ratio of length to width (l/w) is less than 2.5:1.

**3412.6.13 Maximum exit access travel distance.** Evaluate the length of exit access travel to an approved exit. Determine the appropriate points in accordance with the following equation and enter that value into Table 3412.7 under Safety Parameter 3412.6.13, Maximum Exit Access Travel Distance, for means of egress and general safety. The maximum allowable exit access travel distance shall be determined in accordance with Section 1016.1.

$$\text{Points} = 20 \times \frac{\text{Maximum allowable travel distance} - \text{Maximum actual travel distance}}{\text{Max. allowable travel distance}}$$

(Equation 34-6)

**3412.6.14 Elevator control.** Evaluate the passenger elevator equipment and controls that are available to the fire department to reach all occupied floors. Emergency recall and in-car operation of elevator recall controls shall be provided in accordance with the *California Fire Code*. Under the categories and occupancies in Table 3412.6.14, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.14, Elevator Control, for fire safety, means of egress and general safety. The values shall be zero for a single-story building.

**TABLE 3412.6.14  
ELEVATOR CONTROL VALUES**

ELEVATOR TRAVEL	CATEGORIES			
	a	b	c	d
Less than 25 feet of travel above or below the primary level of elevator access for emergency fire-fighting or rescue personnel	-2	0	0	+2
Travel of 25 feet or more above or below the primary level of elevator access for emergency fire-fighting or rescue personnel	-4	NP	0	+4

For SI: 1 foot = 304.8 mm.

NP = Not permitted.

**3412.6.14.1 Categories.** The categories for elevator controls are:

1. Category a—No elevator.
2. Category b—Any elevator without Phase I emergency recall operation and Phase II emergency in-car operation.
3. Category c—All elevators with Phase I emergency recall operation and Phase II emergency in-car operation as required by the *California Fire Code*.
4. Category d—All meet Category c; or Category b where permitted to be without Phase I emergency recall operation and Phase II emergency in-car operation; and at least one elevator that complies with new construction requirements serves all occupied floors.

**3412.6.15 Means of egress emergency lighting.** Evaluate the presence of and reliability of means of egress emergency lighting. Under the categories and occupancies in Table 3412.6.15, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.15, Means of Egress Emergency Lighting, for means of egress and general safety.

**TABLE 3412.6.15  
MEANS OF EGRESS EMERGENCY LIGHTING VALUES**

NUMBER OF EXITS REQUIRED BY SECTION 1015	CATEGORIES		
	a	b	c
Two or more exits	NP	0	4
Minimum of one exit	0	1	1

**3412.6.15.1 Categories.** The categories for means of egress emergency lighting are:

1. Category a—Means of egress lighting and exit signs not provided with emergency power in accordance with Chapter 27.
2. Category b—Means of egress lighting and exit signs provided with emergency power in accordance with Chapter 27.
3. Category c—Emergency power provided to means of egress lighting and exit signs which pro-

vides protection in the event of power failure to the site or building.

**3412.6.16 Mixed occupancies.** Where a building has two or more occupancies that are not in the same occupancy classification, the separation between the mixed occupancies shall be evaluated in accordance with this section. Where there is no separation between the mixed occupancies or the separation between mixed occupancies does not qualify for any of the categories indicated in Section 3412.6.16.1, the building shall be evaluated as indicated in Section 3412.6 and the value for mixed occupancies shall be zero. Under the categories and occupancies in Table 3412.6.16, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.16, Mixed Occupancies, for fire safety and general safety. For buildings without mixed occupancies, the value shall be zero.

**TABLE 3412.6.16  
MIXED OCCUPANCY VALUES<sup>a</sup>**

OCCUPANCY	CATEGORIES		
	a	b	c
A-1, A-2, R	-10	0	10
A-3, A-4, B, E, F, M, S	-5	0	5

a. For fire-resistance ratings between categories, the value shall be obtained by linear interpolation.

**3412.6.16.1 Categories.** The categories for mixed occupancies are:

1. Category a—Occupancies separated by minimum 1-hour fire barriers or minimum 1-hour horizontal assemblies, or both.
2. Category b—Separations between occupancies in accordance with Section 508.4.
3. Category c—Separations between occupancies having a fire-resistance rating of not less than twice that required by Section 508.4.4.

**3412.6.17 Automatic sprinklers.** Evaluate the ability to suppress a fire based on the installation of an automatic sprinkler system in accordance with Section 903.3.1.1. “Required sprinklers” shall be based on the requirements of this code. Under the categories and occupancies in Table 3412.6.17, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.17, Automatic Sprinklers, for fire safety, means of egress divided by 2 and general safety.

**TABLE 3412.6.17  
SPRINKLER SYSTEM VALUES**

OCCUPANCY	CATEGORIES					
	a	b	c	d	e	f
A-1, A-3, F, M, R, S-1	-6	-3	0	2	4	6
A-2	-4	-2	0	1	2	4
A-4, B, E, S-2	-12	-6	0	3	6	12

**3412.6.17.1 Categories.** The categories for automatic sprinkler system protection are:

1. Category a—Sprinklers are required throughout; sprinkler protection is not provided or the sprinkler system design is not adequate for the hazard protected in accordance with Section 903.
2. Category b—Sprinklers are required in a portion of the building; sprinkler protection is not provided or the sprinkler system design is not adequate for the hazard protected in accordance with Section 903.
3. Category c—Sprinklers are not required; none are provided.
4. Category d—Sprinklers are required in a portion of the building; sprinklers are provided in such portion; the system is one which complied with the code at the time of installation and is maintained and supervised in accordance with Section 903.
5. Category e—Sprinklers are required throughout; sprinklers are provided throughout in accordance with Chapter 9.
6. Category f—Sprinklers are not required throughout; sprinklers are provided throughout in accordance with Chapter 9.

**3412.6.18 Standpipes.** Evaluate the ability to initiate attack on a fire by making a supply of water available readily through the installation of standpipes in accordance with Section 905. Required standpipes shall be based on the requirements of this code. Under the categories and occupancies in Table 3412.6.18, determine the appropriate value and enter that value into Table 3412.7 under Safety Parameter 3412.6.18, Standpipes, for fire safety, means of egress and general safety.

**3412.6.18.1 Standpipe.** The categories for standpipe systems are:

1. Category a—Standpipes are required; standpipe is not provided or the standpipe system design is not in compliance with Section 905.3.
2. Category b—Standpipes are not required; none are provided.
3. Category c—Standpipes are required; standpipes are provided in accordance with Section 905.
4. Category d—Standpipes are not required; standpipes are provided in accordance with Section 905.

**3412.6.18  
STANDPIPE SYSTEM VALUES**

OCCUPANCY	CATEGORIES			
	a <sup>a</sup>	b	c	d
A-1, A-3, F, M, R, S-1	-6	0	4	6
A-2	-4	0	2	4
A-4, B, E, S-2	-12	0	6	12

a. This option cannot be taken if Category a or b in Section 3412.6.17 is used.



## EXISTING STRUCTURES

**3412.6.19 Incidental accessory occupancy.** Evaluate the protection of incidental accessory occupancies in accordance with Section 508.2.5. Do not include those where this code requires suppression throughout the buildings, including covered mall buildings, high-rise buildings, public garages and unlimited area buildings. Assign the lowest score from Table 3412.6.19 for the building or floor area being evaluated and enter that value into Table 3412.7 under Safety Parameter 3412.6.19, Incidental Accessory Occupancy, for fire safety, means of egress and general safety. If there are no specific occupancy areas in the building or floor area being evaluated, the value shall be zero.

**3412.7 Building score.** After determining the appropriate data from Section 3412.6, enter those data in Table 3412.7 and total the building score.

**3412.8 Safety scores.** The values in Table 3412.8 are the required mandatory safety scores for the evaluation process listed in Section 3412.6.

**3412.9 Evaluation of building safety.** The mandatory safety score in Table 3412.8 shall be subtracted from the building score in Table 3412.7 for each category. Where the final score for any category equals zero or more, the building is in compliance with the requirements of this section for that category. Where the final score for any category is less than zero, the building is not in compliance with the requirements of this section.

**3412.9.1 Mixed occupancies.** For mixed occupancies, the following provisions shall apply:

1. Where the separation between mixed occupancies does not qualify for any category indicated in Section 3412.6.16, the mandatory safety scores for the occupancy with the lowest general safety score in Table 3412.8 shall be utilized (see Section 3412.6.)
2. Where the separation between mixed occupancies qualifies for any category indicated in Section 3412.6.16, the mandatory safety scores for each occupancy shall be placed against the evaluation scores for the appropriate occupancy.

**TABLE 3412.8  
MANDATORY SAFETY SCORES<sup>a</sup>**

OCCUPANCY	FIRE SAFETY (MFS)	MEANS OF EGRESS (MME)	GENERAL SAFETY (MGS)
A-1	16	27	27
A-2	19	30	30
A-3	18	29	29
A-4, E	23	34	34
B	24	34	34
F	20	30	30
M	19	36	36
R	17	34	34
S-1	15	25	25
S-2	23	33	33

a. MFS = Mandatory Fire Safety;  
MME = Mandatory Means of Egress;  
MGS = Mandatory General Safety.

**TABLE 3412.6.19  
INCIDENTAL ACCESSORY OCCUPANCY AREA VALUES<sup>a</sup>**

PROTECTION REQUIRED BY TABLE 508.2.5	PROTECTION PROVIDED						
	None	1 Hour	AFSS	AFSS with SP	1 Hour and AFSS	2 Hours	2 Hours and AFSS
2 Hours and AFSS	-4	-3	-2	-2	-1	-2	0
2 Hours, or 1 Hour and AFSS	-3	-2	-1	-1	0	0	0
1 Hour and AFSS	-3	-2	-1	-1	0	-1	0
1 Hour	-1	0	-1	0	0	0	0
1 Hour, or AFSS with SP	-1	0	-1	0	0	0	0
AFSS with SP	-1	-1	-1	0	0	-1	0
1 Hour or AFSS	-1	0	0	0	0	0	0

a. AFSS = Automatic fire suppression system; SP = Smoke partitions (See Section 508.2.5).

**Note:** For Table 3412.7, see next page.

**TABLE 3412.7  
SUMMARY SHEET — BUILDING CODE**

Existing occupancy: _____		Proposed occupancy: _____	
Year building was constructed: _____		Number of stories: _____ Height in feet: _____	
Type of construction: _____		Area per floor: _____	
Percentage of open perimeter increase: _____%			
Completely suppressed: Yes _____ No _____		Corridor wall rating: _____	
Compartmentation: Yes _____ No _____		Required door closers: Yes _____ No _____	
Fire-resistance rating of vertical opening enclosures: _____			
Type of HVAC system: _____, serving number of floors: _____			
Automatic fire detection: Yes _____ No _____		Type and location: _____	
Fire alarm system: Yes _____ No _____		Type: _____	
Smoke control: Yes _____ No _____		Type: _____	
Adequate exit routes: Yes _____ No _____		Dead ends: _____ Yes _____ No _____	
Maximum exit access travel distance: _____		Elevator controls: Yes _____ No _____	
Means of egress emergency lighting: Yes _____ No _____		Mixed occupancies: Yes _____ No _____	

SAFETY PARAMETERS	FIRE SAFETY (FS)	MEANS OF EGRESS (ME)	GENERAL SAFETY (GS)
3412.6.1 Building Height 3412.6.2 Building Area 3412.6.3 Compartmentation			
3412.6.4 Tenant and Dwelling Unit Separations 3412.6.5 Corridor Walls 3412.6.6 Vertical Openings			
3412.6.7 HVAC Systems 3412.6.8 Automatic Fire Detection 3412.6.9 Fire Alarm Systems			
3412.6.10 Smoke Control 3412.6.11 Means of Egress Capacity 3412.6.12 Dead Ends	* * * *		
3412.6.13 Maximum Exit Access Travel Distance 3412.6.14 Elevator Control 3412.6.15 Means of Egress Emergency Lighting	* * * *		
3412.6.16 Mixed Occupancies 3412.6.17 Automatic Sprinklers 3412.6.18 Standpipes 3412.6.19 Incidental Accessory Occupancy		* * * * ÷ 2 =	
<b>Building score — total value</b>			

\* \* \* \*No applicable value to be inserted.

**TABLE 3412.8  
MANDATORY SAFETY SCORES<sup>a</sup>**

OCCUPANCY	FIRE SAFETY (MFS)	MEANS OF EGRESS (MME)	GENERAL SAFETY (MGS)
A-1	20	31	31
A-2	21	32	32
A-3	22	33	33
A-4, E	29	40	40
B	30	40	40
F	24	34	34
M	23	40	40
R	21	38	38
S-1	19	29	29
S-2	29	39	39

a. MFS = Mandatory Fire Safety  
MME = Mandatory Means of Egress  
MGS = Mandatory General Safety

**TABLE 3412.9  
EVALUATION FORMULAS<sup>a</sup>**

FORMULA	T.3410.7	T.3410.8	SCORE	PASS	FAIL
FS-MFS $\geq 0$	_____ (FS) – _____ (MFS) =	_____	_____	_____	_____
ME-MME $\geq 0$	_____ (ME) – _____ (MME) =	_____	_____	_____	_____
GS-MGS $\geq 0$	_____ (GS) – _____ (MGS) =	_____	_____	_____	_____

a. FS = Fire Safety  
ME = Means of Egress  
GS = General Safety

MFS = Mandatory Fire Safety  
MME = Mandatory Means of Egress  
MGS = Mandatory General Safety

### **SECTION 3413 EXISTING GROUP R-1 AND GROUP R-2 OCCUPANCIES [SFM]**

**3413.1 Scope.** The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings classified as Group R Occupancies.

**3413.1.1 Application.** In accordance with Health and Safety Code Section 13143.2, the provisions of Sections 3413.2 through 3413.12 shall only apply to multiple-story structures existing on January 1, 1975, let for human habitation, including, and limited to, apartment houses, hotels, and motels wherein rooms used for sleeping are let above the ground floor.

**3413.2 Number of exits.** Every apartment and every other sleeping room shall have access to not less than two exits when the occupant load is 10 or more (exits need not be directly from the apartment or sleeping room). A fire escape as specified herein may be used as one required exit.

Subject to approval of the authority having jurisdiction, a ladder device as specified herein may be used in lieu of a fire escape when the construction feature or the location of the

building on the property cause the installation of a fire escape to be impractical.

**3413.3 Stair construction.** All stairs shall have a minimum run of 9 inches (229 mm) and a maximum rise of 8 inches (203 mm) and a minimum width exclusive of handrails of 30 inches (762 mm). Every stairway shall have at least one handrail. A landing having a minimum horizontal dimension of 30 inches (762 mm) shall be provided at each point of access to the stairway.

**3413.4 Interior stairways.** Every interior stairway shall be enclosed with walls of not less than one-hour fire-resistive construction. Where existing partitions form part of a stairwell enclosure, wood lath and plaster in good condition will be acceptable in lieu of one-hour fire-resistive construction. Doors to such enclosures shall be protected by a self-closing door equivalent to a solid wood door with a thickness of not less than 1<sup>3</sup>/<sub>4</sub> inches (44.5 mm).

Enclosures shall include all landings between flights and any corridors, passageways or public rooms necessary for continuous exit to the exterior of the buildings. The stairway need not be enclosed in a continuous shaft if cut off at each story by the fire-resistive construction required by this subsection for stairwell enclosures. Enclosures shall not be required if an automatic sprinkler system is provided for all portions of the

building except bedrooms, apartments and rooms accessory thereto. Interior stairs and vertical openings need not be enclosed in two-story buildings.

**3413.5 Exterior stairways.** Exterior stairways shall be noncombustible or of wood of not less than 2-inch (51 mm) nominal thickness with solid treads and risers.

**3413.6 Fire escapes, exit ladder devices.** Fire escapes may be used as one means of egress if the pitch does not exceed 60 degrees, the width is not less than 18 inches (457 mm), the treads are not less than 4 inches (102 mm) wide, and they extend to the ground or are provided with counterbalanced stairs reaching to the ground. Access shall be by an opening having a minimum dimension of 29 inches (737 mm) when open. The sill shall not be more than 30 inches (762 mm) above the floor and landing.

A ladder device, when used in lieu of a fire escape, shall conform to Section 3413.6.1 and the following:

Serves an occupant load of nine people or less or a single dwelling unit or hotel room.

The building does not exceed three stories in height.

The access is adjacent to an opening as specified for emergency egress or rescue or from a balcony.

The device does not pass in front of any building opening below the unit being served.

The availability of activating the ladder device is accessible only to the opening or balcony served.

The device as installed will not cause a person using it to be within 12 feet (3658 mm) of exposed energized high-voltage conductors.

#### **3413.6.1 Exit ladder devices.**

**3413.6.1.1 Scope.** This standard for exit ladder devices is applicable where such devices are permitted by the building official for installation on existing apartment houses and hotels in conformance with the California Building Code.

**3413.6.1.2 Instructions.** Installation shall be in accordance with the manufacturer's instructions. Instructions shall be illustrated and shall include directions and information adequate for attaining proper and safe installation of the product. Where exit ladder devices are intended for mounting on different support surfaces, specific installation instructions shall be provided for each surface.

**3413.6.1.3 General design.** All load-bearing surfaces and supporting hardware shall be of noncombustible materials. Exit ladder devices shall have a minimum width of 12 inches (305 mm) when in the position intended for use. The design load shall not be less than 400 pounds (1780 N) for 16-foot (4877 mm) length and 600 pounds (2699 N) for 25-foot (7620 mm) length.

#### **3413.6.1.4 Performance.**

**3413.6.1.4.1** Exit ladder devices shall be capable of withstanding an applied load of four times the design load when installed in the manner intended for use. Test loads shall be applied for a period of one hour.

**3413.6.1.4.2** Exit ladder devices of the retractable type shall, in addition to the static load requirements of Section 413.6.1.4.1, be capable of withstanding the following tests:

1. Rung strength
2. Rung-to-side-rail shear strength
3. Release mechanism
4. Low temperature

**3413.6.1.5 Rung-strength test.** Rungs of retractable exit ladder devices shall be capable of withstanding a load of 1,000 pounds (4448 N) when applied to a 3½-inch-wide (89 mm) block resting at the center of the rung. The test load shall be applied for a period of one hour. The ladder shall remain operational following this test.

**3413.6.1.6 Rung-to-side-rail shear test.** Rungs of retractable exit ladder devices shall be capable of withstanding 1,000 (4448 N) when applied to a 3½-inch-wide (89 mm) block resting on the center rung as near the side rail as possible. The test load shall be applied for a period of one hour. Upon removal of the test load the fasteners attaching the rung to the side rail shall show no evidence of failure. The ladder shall remain operational following the test.

**3413.6.1.7 Release mechanism test.** The release mechanism of retractable exit ladder devices shall operate with an average applied force of not more than 5 pounds (22.2 N) for hand-operated releasing mechanisms and an average applied force of not more than 25 pounds (111 N) for foot-pedal types of releasing mechanisms. For these tests, a force gauge shall be applied to the release mechanism, and the average of three consecutive readings shall be computed.

**3413.6.1.8 Low temperature operation test.** Representative samples of the exit ladder devices shall be subjected to a temperature of -40°C in an environmental chamber for a period of 24 hours. The release mechanism shall be operated immediately upon removal from the chamber. The ladder device shall function as intended without any restriction of operation.

**3413.7 Doors and openings.** Exit doors and openings shall meet the requirements of Sections 1008.1.2, 1008.8.1.8, 1008.1.9 and 708.6. Doors shall not reduce the required width of stairway more than 6 inches (152 mm) when open. Transoms and openings other than doors from corridors to rooms shall be fixed closed and shall be covered with a minimum of ¾-inch (19 mm) plywood or ½-inch (13 mm) gypsum wallboard or equivalent material.

#### **Exceptions:**

1. Existing solid-bonded wood-core doors 1⅜ inches thick (34.9 mm), or their equivalent may be continued in use.
2. Where the existing frame will not accommodate a door complying with Section 708.6, a 1⅜-inch-thick (35 mm) solid-bonded wood-core door may be used.



**3413.8 Exit signs.** Every exit doorway or change of direction of a corridor shall be marked with a well-lighted exit sign having letters at least 5 inches (127 mm) high.

**3413.9 Enclosure of vertical openings.** Elevators, shafts, ducts and other vertical openings shall be enclosed as required for stairways in Section 3413.5 or by wired glass set in metal frames. Doors shall be noncombustible or as regulated in Section 3413.5.

**3413.10 Separation of occupancies.** Occupancy separations shall be provided as specified in Section 508. Lobbies and public dining rooms, not including cocktail lounges, shall not require a separation if the kitchen is so separated from the dining room. Every room containing a boiler or central heating plant shall be separated from the rest of the building by not less than a one-hour fire-resistive occupancy separation.

**Exception:** A separation shall not be required for such rooms with equipment serving only one dwelling unit.

**3413.11 Equivalent protection.** In lieu of the separation of occupancies required by Section 3413.10, equivalent protection may be permitted when approved by the enforcement agency.

**Exception:** The provisions of Sections 3413.3 through 3413.11 above shall not apply to any existing apartment house, hotel or motel having floors (as measured from the top of the floor surface) used for human occupancy located more than 75 feet (22 860 mm) above the lowest floor level having building access which is subject to the provisions of Section 33414, California Building Code, relating to existing high-rise buildings.

**Note:** In accordance with Health and Safety Code Section 17920.7, the provisions of Sections 3413.3 through 3413.11 above shall apply only to multiple-story structures existing on January 1, 1975, let for human habitation including, and limited to, apartments, houses, hotels and motels wherein rooms used for sleeping are let above the ground floor.

### 3413.12 Fire alarms.

**3413.12.1 General.** Every apartment house three or more stories in height or containing more than 15 apartments, every hotel three or more stories in height or containing 20 or more guest rooms, shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously and shall be in accordance with the California Fire Code. See Section 3414.14 for special requirements in buildings over 75 feet (22 860 mm) in height.

**Exception:** A fire alarm system need not be installed provided such apartment house or hotel is separated by an unpierced wall of not less than four-hour fire resistance in buildings of Type IA, Type IIB, Type III or Type IV construction and two-hour fire resistance in buildings of all other types of construction provided:

1. Areas do not exceed the number of apartments or guest rooms stipulated.

2. The fire-resistive wall conforms to the requirements of Section 706.6.
3. The wall complies with all other applicable provisions of the California Building Code.
4. The wall extends to all outer edges of horizontal projecting elements, such as balconies, roof overhangs, canopies, marquees or architectural projections.
5. No openings are permitted for air ducts or similar penetrations, except that openings for pipes, conduits and electrical outlets of copper, sheet steel or ferrous material shall be permitted through such wall and need not be protected, provided they do not unduly impair the required fire resistance of the assembly.
6. Tolerances around such penetrations shall be filled with approved noncombustible materials..

**3413.12.2 Installation.** The installation of all fire alarm equipment shall be in accordance with the California Fire Code.

### 3413.13 Existing Group R Occupancy high-rise buildings.

**3413.13.1 General.** Regardless of other provisions of these regulations relating to existing high-rise buildings, requirements relative to existing Group R-1 or Group R-2 Occupancies shall not be less restrictive than those established pursuant to Health and Safety Code Section 13143.2.

**3413.13.2 Corridor openings.** Openings in corridor walls and ceilings shall be protected by not less than 1<sup>3</sup>/<sub>4</sub>-inch (44.5 mm) solid-bonded wood-core doors, 1/4-inch-thick (6 mm) wired glass conforming to Section 715.1, by approved fire dampers or by equivalent protection in lieu of any of these items. Transoms shall be fixed closed with material having a fire-resistive rating equal to 1/2-inch (12.7 mm) Type X gypsum wallboard or equivalent material installed on both sides of the opening.

**3413.13.3 Fire alarm systems.** Notwithstanding the provisions of Section 403, every existing high-rise building used for the housing of a Group R-1 or Group R-2 Occupancies shall have installed therein a fire alarm system conforming to this subsection.

**3413.13.3.1 General.** Every apartment house and every hotel shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously.

**3413.13.3.2 Installation.** The installation of all fire alarm equipment shall be in accordance with the California Fire Code.

**3413.13.3.3 Fire-extinguishing systems.** Automatic fire-extinguishing systems installed in any structure subject to these regulations shall have an approved flow indicator electrically interconnected to the required fire alarm system.

## SECTION 3414 EXISTING HIGH-RISE BUILDINGS [SFM]

**3414.1 Scope and definition.** The provisions of Sections 3414.1 through 3414.27 shall apply to every existing high-rise building of any type of construction or occupancy having floors (as measured from the top of the floor surface) used for human occupancy located more than 75 feet (22 860 mm) above the lowest floor level having building access.

### Exceptions:

1. Hospitals, as defined in Section 1250 of the Health and Safety Code.
2. The following structures, while classified as high-rise buildings, shall not be subject to the provisions of Sections 3414.1 through 3414.27, but shall conform to all applicable provisions of these regulations.
  - 2.1 Building used exclusively as open parking garages.
  - 2.2 Buildings where all floors above the 75 foot (22 860 mm) level are used exclusively as open parking garages.
  - 2.3 Floors of buildings used exclusively as open parking garages and located above all other floors used for human occupancy.
  - 2.4 Buildings such as power plants, look-out towers, steeples, grain houses, and similar structures, when so determined by the enforcing agency.
  - 2.5 Buildings used exclusively for jails and prisons.

For the purposes of this section, “building access” shall mean an exterior door opening conforming to all of the following:

1. Suitable and available for fire department use.
2. Located not more than 2 feet (610 mm) above the adjacent ground level.
3. Leading to a space, room or area having foot traffic communication capabilities with the remainder of the building.
4. Designed to permit penetration through the use of fire department forcible-entry tools and equipment unless other approved arrangements have been made with the fire authority having jurisdiction.

“Existing high-rise structure” means a high-rise structure, the construction of which is commenced or completed prior to July 1, 1974.

For the purpose of this section, construction shall be deemed to have commenced when plans and specifications are more than 50 percent complete and have been presented to the local jurisdiction prior to July 1, 1974. Actual construction of such buildings shall commence on or before January 1, 1976, unless all provisions for new buildings have been met.

**Note:** It is the intent of this section that, in determining the level from which the highest occupied floor is to be

measured, the enforcing agency should exercise reasonable judgment, including consideration of overall accessibility to the building by fire department personnel and vehicular equipment. When a building is situated on sloping terrain and there is building access on more than one level, the enforcing agency may select the level which provides the most logical and adequate fire department access.

**3414.2 Compliance data.** Except as may be otherwise specified, existing high-rise building shall conform to the applicable requirements of these regulations by April 26, 1979.

**Exception:** The period of compliance may be extended upon showing of good cause for such extension if a systematic and progressive plan of correction is submitted to, and approved by, the enforcing agency. Such extension shall not exceed two years from the date of approval of such plan. Any plan of correction submitted pursuant to this exception shall be submitted and approved on or before April 26, 1979.

**3414.3 Continued use.** Existing high-rise building may have their use continued if they conform, or are made to conform, to the intent of the provisions of Sections 3414.5 through 3414.27 to provide for the safety of the occupants of the high-rise buildings and person involved in fire-suppression activities.

**3414.4 Alternate protection.** Alternate means of egress, fire walls or fire barriers, smoke barriers, automatic fire detection or fire-extinguishing systems, or other fire-protection devices, equipment or installations may be approved by the enforcing agency to provide reasonable and adequate life safety as intended by Sections 3414.5 through 3414.27 for existing high-rise buildings.

**3414.5 Basic provisions.** The provisions outlined in Sections 3414.1 through 3414.27 are applicable to every existing high-rise building.

**3414.6 Minimum construction.** Existing wood lath and plaster, existing  $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard, existing installations of  $\frac{1}{2}$ -inch thick (12.7 mm) wired glass which are or are rendered inoperative and fixed in a closed position, or other existing materials having similar fire-resistive capabilities shall be acceptable. All such assemblies shall be in good repair, free of any condition which would diminish their original fire-resistive characteristics.

Where  $1\frac{3}{4}$ -inch (44.5 mm) solid-bonded wood-core doors are specified in these regulations for existing high-rise buildings, new or existing  $1\frac{3}{8}$ -inch (34.9 mm) doors shall be acceptable where existing framing will not accommodate a  $1\frac{3}{4}$ -inch (44.5 mm) door.

**Note:** It is the intent of this provisions that existing wood frames may have their use continued.

**3414.7 New construction.** All new construction shall be composed of materials and assemblies of materials conforming to the fire-resistive provisions of these regulations. In no case shall enclosure walls be required to be of more than one-hour fire-resistive construction.

**Exception:** When approved by the enforcing agency, materials specified in Section 3414.6 may be used for new con-

struction when necessary to maintain continuity of design and measurement of existing construction.

**3414.8 Exits.** Every floor from an existing high-rise building shall have access to two separate means of egress, one of which, when approved by the enforcing agency, may be an existing exterior fire escape.

New installations of smoke-proof enclosures shall not be required.

**Note:** In determining the adequacy of exits and their design, Chapter 10 may be used as a guide. It is the intent of this section that every existing high-rise building need not mandatorily conform or be made to conform with the requirements for new high-rise buildings. Reasonable judgment in the application of requirements must be exercised by the enforcing agency.

**3414.9 Fire escapes.** An existing fire escape in good structural condition may be acceptable as one of the required means of egress from each floor. Access to such fire escapes may be by any one of the following:

Through a room between the corridor and the fire escape if the door to the room is operable from the corridor side without the use of any key, special knowledge or effort.

By a door operable to a fire escape from the interior without the use of any key, special knowledge or effort.

By a window operable from the interior. Such window shall have a minimum dimension of 29 inches (737 mm) when open. The sill shall not be more than 30 inches (762 mm) above the floor and landing.

**3414.10 Protection of exterior openings.** When an existing fire escape is accepted as one of the required means of egress, openings onto the fire escape landing and openings within 5 feet (1524 mm) horizontally of the landings shall be protected in a manner acceptable to the enforcing agency.

**3414.11 Locking of stairway doors.** When exit doors from corridors to exit stairways are locked to prohibit access from the stairway side, the locking mechanisms shall be retracted to the unlocked position upon failure of electrical power and a telephone or other two-way communication system connected to an approved emergency service that operates continuously shall be provided at not less than every fifth floor in each required stairway. In lieu thereof, master keys which will unlock all such doors from the stairway side shall be provided in such numbers and locations as approved by the enforcing agency.

**3414.12 Enclosures.** Interior vertical shafts, including but not limited to, elevators, stairway and utility, shall be enclosed with construction as set forth in Section 3414.6.

**3414.13 Opening protection.** Doors in other than elevators, which shall be of a type acceptable to the enforcing agency, shall be approved one-hour, fire-rated, tight-fitting or gasketed doors or equivalent protection, and shall be of the normally closed type, self-closing or a type which will close automatically in accordance with Section 715.

**Exception:** In lieu of stairway enclosures, smoke barriers may be provided in such a manner that fire and smoke will not spread to other floors or otherwise impair exit facilities.

In these instances, smoke barriers shall not be less than one-hour fire resistive with openings protected by not less than approved one-third-hour, fire-rated, tight-fitting or gasketed doors. Such doors shall be of the self-closing type or of a type which will close automatically in the manner specified in Section 715.

Doors crossing corridors shall be provided with wired-glass vision panels set in approved steel frames.

Doors for elevators shall not be of the open-grille type.

**3414.14 Fire alarm system.** Every existing high-rise building shall be provided with an approved fire alarm system. In department stores, retail sales stores and similar occupancies where the general public is admitted, such systems shall be of a type capable of alerting staff and employees. In office buildings and all other high-rise buildings, such systems shall be of a type capable of alerting all occupants simultaneously.

**Exceptions:**

1. In areas of public assemblage, the type and location of audible appliances shall be as determined by the enforcing agency.
2. When acceptable to the enforcing agency, the occupant voice notification system required by Section 3414.17 may be used in lieu of the fire alarm system required by Section 3414.14.

**3414.15 Existing systems.** Existing fire systems, when acceptable to the enforcing agency, shall be deemed as conforming to the provisions of these regulations. For requirements for existing Group R-1 Occupancies, see Section 3412.13.

**3414.16 Annunciation.** When a new fire alarm system is installed, it shall be connected to an annunciator panel installed in a location approved by the enforcing agency.

For purposes of annunciation, zoning shall be in accordance with Section 907.6.3.

**3414.17 Monitoring.** Shall be in accordance with Section 907.6.5.

**3414.18 Systems interconnection.** When an automatic fire detection system or automatic extinguishing system is installed, activation of such system shall cause the sounding of the fire alarm notification appliances at locations designated by the enforcing agency.

**3414.19 Manual fire alarm boxes.** A manual fire alarm box shall be provided in the locations designated by the enforcing agency. Such locations shall be where boxes are readily accessible and visible and in normal paths of daily travel by occupants of the building.

**3414.20 Emergency voice/alarm communication system.** An approved emergency voice/alarm system shall be provided in every existing high-rise building which exceeds 150 feet (45 720 mm) in height measured in the manner set forth in Section 3412.1. Such system shall provide communication from a location available to and designated by the enforcing agency to not less than all public areas.

The emergency voice/alarm system may be combined with a fire alarm system provide the combined system has been approved and listed by the State Fire Marshal. The sounding of



a fire alarm signal in any given area or floor shall not prohibit voice communication to other areas of floors. Combination systems shall be designed to permit voice transmission to override the fire alarm signal, but the fire alarm signal shall not terminate in less than three minutes.

**3414.21 Fire department system.** When it is determined by test that portable fire department communication equipment is ineffective, a communication system acceptable to the enforcing agency shall be installed within the building to permit emergency communication between fire-suppression personnel.

**3414.22 Interior wall and ceiling finish.** Interior wall and ceiling finish of exitways shall conform to the provisions of Chapter 8. Where the materials used in such finishes do not conform to the provisions of Chapter 8, such finishes may be surfaced with an approved fire-retardant coating.

**3414.23 Ventilation.** Natural or mechanical ventilation for the removal of products of combustion shall be provided in every story of an existing high-rise building. Such ventilation shall be any one or combination of the following:

Panels or windows in the exterior wall which can be opened. Such venting facilities shall be provided at the rate of at least 20 square feet (1.86 m<sup>2</sup>) of opening per 50 lineal feet (15 240 lineal mm) of exterior wall in each story, distributed around the perimeter at not more than 50-foot (15 240 mm) intervals on at least two sides of the building.

Approved fixed tempered glass may be used in lieu of openable panels or windows. When only selected panels or windows are of tempered glass, they shall be clearly identified as required by the enforcing agency. Any other design which will produce equivalent results.

**3414.24 Smoke control systems.** Existing air-circulation systems shall be provided with an override switch in a location approved by the enforcing agency which will allow for the manual control of shutdown of the systems.

**Exception:** Systems which serve only a single floor, or portion thereof, without any penetration by ducts or other means into adjacent floors.

**3414.25 Elevator recall smoke detection.** Smoke detectors for emergency operation of elevators shall be provided as required by Section 3003.

**3414.26 Exit signs and illumination.** Exits and stairways shall be provided with exit signs and illumination as required by Sections 1011.1 and 1011.2.

**3414.27 Automatic sprinkler system—Existing high-rise buildings.** Regardless of any other provisions of these regulations, every existing high-rise building of Type II-B, Type III-B or Type V-B construction shall be provided with an approved automatic sprinkler system conforming to NFPA 13.

## SECTION 3415 EXISTING GROUP I OCCUPANCIES [SFM]

**3415.1 General.** Existing buildings housing existing protective social-care homes or facilities established prior to March 4, 1972 may have their use continued if they conform, or are made to conform, to the following provisions:

**3415.2 Use of floors.** The use of floor levels in buildings of Type III, IV or V nonfire-rated construction may be as follows:

Nonambulatory—first floor only;

Ambulatory—not higher than the third-floor level, provided walls and partitions are constructed of materials equal in fire-resistive quality to that of wood lath and plaster in good repair and all walls are firestopped at each floor level.

**3415.3 Enclosure of exits and vertical openings.** Except for two-story structures housing ambulatory guests, all interior stairs shall be enclosed in accordance with Chapter 10. In lieu of stairway enclosures, floor separations or smoke barriers may be provided in such a manner that fire and smoke will not spread rapidly to floors above or otherwise impair exit facilities. In these instances, floor separations or smoke barriers shall have a fire resistance equal to not less than 1/2-inch (13 mm) gypsum wall board on each side of wood studs with openings protected by not less than a 1 3/4-inch (44.5 mm) solid bonded wood-core door of the self-closing type. All other vertical openings shall be enclosed in accordance with the provisions of Section 3414.6 and 3414.13.

**3415.4 Exit access.** Each floor or portion thereof of buildings used for the housing of existing protective social-care homes or facilities shall have access to not less than two exits in such a manner as to furnish egress from the building or structure in the event of an emergency substantially equivalent to the provisions of Chapter 10.

**3415.5 Corridor openings.** Openings from rooms to interior corridors shall be protected by not less than 1 3/4-inch (44.5 mm) solid-bonded wood-core doors. Transoms and other similar openings shall be sealed with materials equivalent to existing corridor wall construction.

**3415.6 Interior finishes.** Interior wall and ceiling finishes shall conform to the requirements for a Group R-1 Occupancy as specified in Chapter 8.

**3415.7 Automatic fire sprinklers.** Automatic sprinkler systems shall be installed in existing protective social-care occupancies in accordance with the provisions of Section 903.2.6.

**3415.8 Fire alarm systems.** Automatic fire alarm systems shall be installed in existing protective social-care homes or facilities in accordance with the provisions of Section 907.2.6.

**Exception:** When an approved automatic sprinkler system conforming to Section 903.2.6 is installed, a separate fire alarm system as specified in this section need not be provided.

## SECTION 3416 EXISTING GROUP L OCCUPANCIES [SFM]

### 3416 Existing Group L Occupancies.

**3416.1 Repairs general.** Additions, alterations or repairs may be made to any building or structure without requiring the existing building or structure to comply with all the requirements of this code section, provided the addition, alteration, or repair conforms to the requirements of this section.



**3416.2 Unsafe condition.** Additions, repairs or alterations shall not be made to an existing building or structure that will cause the existing building or structure to be in violation of any of the provisions of this code, nor shall such additions or alterations cause the existing building or structure to become unsafe, or to be in violation of any of the provisions of this code. An unsafe condition shall be deemed to have been created if an addition or alteration will cause the existing building or structure to become structurally unsafe or overloaded; will not provide adequate egress in compliance with the provisions of this code or will obstruct existing exits; will create a fire hazard; will reduce required fire resistance or will otherwise create conditions dangerous to human life.

**3416.3 Changes in use or occupancy.** Any buildings that have alternations or additions, which involves a change in use or occupancy, shall not exceed the height, number of stories and area permitted for new buildings

**3416.4 Buildings not in compliance with code.** Additions or alterations shall not be made to an existing building or structure when such existing building or structure is not in full compliance with the provisions of this code except when such addition or alteration will result in the existing building or structure being no more hazardous, based on life safety, fire safety and sanitation, than before such additions or alterations are undertaken.

**3416.5 Maintenance of structural and fire resistive integrity.** Alterations or repairs to an existing building or structure that are nonstructural and do not adversely affect any structural member of any part of the building or structure having required fire resistance may be made with the same materials of which the building or structure is constructed. The installation or replacement of glass shall be as required for new installations.

**3416.6 Continuation of existing use.** Buildings in existence at the time of the adoption of this code may have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of this code, provided such continued use is not dangerous to life.

**3416.7 Maximum allowable quantities.** Laboratory suites approved prior to January 1, 2008 shall not exceed the maximum allowable quantities listed in Tables 3416.1 and 3416.2.

## SECTION 3417 EARTHQUAKE EVALUATION AND DESIGN FOR RETROFIT OF EXISTING BUILDINGS

### 3417.1 Purpose.

**3417.1.1 Existing state-owned structures.** The provisions of Sections 3417 through 3423 establish minimum standards for earthquake evaluation and design for retrofit of existing state-owned structures, including buildings owned by the University of California and the California State University.

The provisions of Sections 3417 through 3423 may be adopted by a local jurisdiction for earthquake evaluation and design for retrofit of existing buildings.

**3417.1.2 Public school buildings.** The provisions of Sections 3417 through 3423 establish minimum standards for

earthquake evaluation and design for the rehabilitation of existing buildings for use as public school buildings under the jurisdiction of the Division of the State Architect-Structural Safety (DSA-SS), refer to Section 1.9.2.1.

The provisions of Section 3417 through 3423 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing public buildings currently under the jurisdiction of DSA-SS.

**3417.1.2.1 Reference to other chapters.** For public schools, where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21 or 22, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A respectively shall apply instead.

**3417.1.3 Community college buildings.** The provisions of Sections 3417 through 3423 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as community college buildings under the jurisdiction of the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), refer to Section 1.9.2.2.

The provisions of Section 3417 through 3423 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing community college buildings currently under the jurisdiction of DSA-SS/CC.

**3417.1.3.1 Reference to other chapters.** For community colleges, where reference within this chapter is made to sections in Chapters 17 or 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

**3417.2 Scope.** All modifications, structurally connected additions and/or repairs to existing structures or portions thereof shall, at a minimum, be designed and constructed to resist the effects of seismic ground motions as provided in this section. The structural system shall be evaluated by a registered design professional and, if not meeting or exceeding the minimum seismic design performance requirements of this section, shall be retrofitted in compliance with these requirements.

**Exception:** Those structures for which Section 3417.3 determines that assessment is not required, or for which Section 3417.4 determines that retrofit is not needed, then only the requirements of Section 3417.11 apply.

### 3417.3 Applicability.

**3417.3.1 Existing state-owned buildings.** For existing state-owned structures including all buildings owned by the University of California and the California State University, the requirements of Section 3417 apply whenever the structure is to be retrofitted, repaired or modified and any of the following apply:

1. Total construction cost, not including cost of furnishings, fixtures and equipment, or normal maintenance, for the building exceeds 25 percent of the construction cost for the replacement of the existing building.

The changes are cumulative for past modifications to the building that occurred after adoption of the 1995 California Building Code and did not require seismic retrofit.

2. There are changes in risk category.

**TABLE 3416.7(1)**  
**EXEMPT AMOUNTS OF HAZARDOUS MATERIALS, LIQUIDS AND CHEMICALS**  
**PRESENTING A PHYSICAL HAZARD BASIC QUANTITIES PER LABORATORY SUITE<sup>1</sup>**  
**When two units are given, values within parentheses are in cubic feet (cu. ft) or pounds (lb)**

CONDITION		STORAGE			USE CLOSED SYSTEMS			USE OPEN SYSTEMS		
MATERIAL	CLASS	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)
1.1 Combustible liquid	II	—	120 <sup>2</sup>	—	—	120	—	—	30	—
	III-A	—	330 <sup>2</sup>	—	—	330	—	—	80	—
	III-B	—	13,200 <sup>2</sup>	—	—	13,200	—	—	3,300	—
1.2 Combustible dust lbs./1000 cu. ft.		1	—	—	1	—	—	1	—	—
1.3 Combustible fiber (loose) (baled)		(100)	—	—	(100)	—	—	(20)	—	—
		(1,000)	—	—	(1,000)	—	—	(200)	—	—
1.4 Cryogenic, flammable or oxidizing			45	—	—	45	—	—	10	—
2.1 Explosives		12	(1) <sup>2</sup>	—	1/4	(1/4)	—	1/4	(1/4)	—
3.1 Flammable solid		125 <sup>2</sup>	—	—	25	—	—	25	—	—
3.2. Flammable gas (gaseous) (liquefied)		—	—	750 <sup>2</sup>	—	—	750 <sup>2</sup>	—	—	—
		—	15 <sup>2</sup>	—	—	15 <sup>2</sup>	—	—	—	—
3.3 Flammable liquid Combination I-A, I-B, I-C	I-A	—	30 <sup>2</sup>	—	—	30	—	—	10	—
	I-B	—	60 <sup>2</sup>	—	—	60	—	—	15	—
	I-C	—	90 <sup>2</sup>	—	—	90	—	—	20	—
		—	120 <sup>2</sup>	—	—	120	—	—	30	—
4.1 Organic peroxide, unclassified detonatable		1 <sup>2</sup>	(1) <sup>2</sup>	—	1/4	(1/4)	—	1/4	(1/4)	—
4.2 Organic peroxide	I	5 <sup>2</sup>	(5) <sup>2</sup>	—	(1)	(1)	—	1	1	—
	II	50 <sup>2</sup>	(50) <sup>2</sup>	—	50	(50)	—	10	(10)	—
	III	125 <sup>2</sup>	(125) <sup>2</sup>	—	125	(125)	—	25	(25)	—
	IV	500	(500)	—	500	(500)	—	100	(100)	—
	V	N.L.	N.L.	—	N.L.	N.L.	—	N.L.	N.L.	—
4.3 Oxidizer	4	1 <sup>2</sup>	(1) <sup>2</sup>	—	1/4 <sup>2</sup>	(1/4)	—	1/4	(1/4)	—
	3	10 <sup>2</sup>	(10) <sup>2</sup>	—	2	(2)	—	2	(2)	—
	2	250 <sup>2</sup>	(250) <sup>2</sup>	—	50	(250)	—	50	(50)	—
	1	1,000 <sup>2</sup>	(1,000) <sup>2</sup>	—	1,000	(1,000)	—	200	(200)	—
4.4 Oxidizer: Gas (gaseous) (liquefied)		—	—	1,500 <sup>2</sup>	—	—	1,500 <sup>2</sup>	—	—	—
		—	15 <sup>2</sup>	—	—	15 <sup>2</sup>	—	—	—	—
5.1 Pyrophoric		4 <sup>2</sup>	(4) <sup>2</sup>	50 <sup>2</sup>	1	(1)	10 <sup>2</sup>	0	0	0
6.1 Unstable (reactive)	4	1 <sup>2</sup>	(1) <sup>2</sup>	10 <sup>2</sup>	1/4	(1/4)	2 <sup>2</sup>	1/4	(1/4)	0
	3	5 <sup>2</sup>	(5) <sup>2</sup>	50 <sup>2</sup>	1	(1)	10 <sup>2</sup>	1	(1)	0
	2	50 <sup>2</sup>	(50) <sup>2</sup>	250 <sup>2</sup>	50	(50)	250 <sup>2</sup>	10	(10)	0
	1	125 <sup>2</sup>	(125) <sup>2</sup>	750 <sup>2</sup>	125	(125)	750 <sup>2</sup>	25	(25)	0
7.1 Water (reactive)	3	5 <sup>2</sup>	(5) <sup>2</sup>	—	5	(5)	—	1	(1)	—
	2	50 <sup>2</sup>	(50) <sup>2</sup>	—	50	(50)	—	10	(10)	—
	1	125 <sup>2</sup>	(125) <sup>2</sup>	—	125	(125) <sup>2</sup>	—	25	(25)	—

1. A laboratory suite is a space up to 10,000 square feet (929 m<sup>2</sup>) bounded by not less than a one-hour fire-resistive occupancy separation within which the exempt amounts of hazardous materials may be stored, dispensed, handled or used. Up through the third floor and down through the first basement floor, the quantity in this table shall apply. Fourth, fifth and sixth floors and the second and third basement floor level quantity shall be reduced to 75 percent of this table. The seventh through 10th floor and below the third basement floor level quantity shall be reduced to 50 percent of this table.
2. Quantities may be increased 100 percent when stored in approved exhausted gas cabinets, exhausted enclosures or fume hoods.

**TABLE 3416.7(2)**  
**EXEMPT AMOUNTS OF HAZARDOUS MATERIALS, LIQUIDS AND CHEMICALS PRESENTING A HEALTH HAZARD MAXIMUM**  
**QUANTITIES PER LABORATORY SUITE<sup>1</sup>**  
**When two units are given, values within parentheses are in pounds (lbs.)**

MATERIAL	STORAGE			USE CLOSED SYSTEMS			USE OPEN SYSTEMS	
	Solid lb	Liquid Gallons (lb)	Gas cu. ft	Solid lb	Liquid Gallons (lb)	Gas cu. ft	Solid lb	Liquid Gallons (lb)
1. Corrosives	5,000	500	650 <sup>2</sup>	5,000	500	650	1,000	100
2a. Highly toxics <sup>2</sup>	40	10	65	5	1	65	2	1/4
2b. Toxics	500	50	650 <sup>2</sup>	500	50	650	5	1/2
3. Irritants	5,000	500	650	5,000	500	650	1,000	100
4. Sensitizers	5,000	500	650	5,000	500	650	1,000	100
5. Other health hazards	5,000	500	650	5,000	500	650	1,000	100

1. A laboratory suite is a space up to 10,000 square feet (929 m<sup>2</sup>) bounded by not less than a one-hour fire-resistive occupancy separation within which the exempt amounts of hazardous materials may be stored, dispensed, handled or used. Up through the third floor and down through the first basement floor, the quantity in this table shall apply. Fourth, fifth and sixth floors and the second and third basement floor level quantity shall be reduced to 75 percent of this table. The seventh through 10th floor and below the third basement floor level quantity shall be reduced to 50 percent of this table.

2. Permitted only when stored or used in approved exhausted gas cabinets, exhausted enclosures or fume hoods. Quantities of high toxics in use in open systems need not be reduced above the third floor or below the first basement floor level. Individual container size shall be limited to 2 pounds (0.91 kg) for solids and 1/4 gallon (0.95 L) for liquids.

3. The modification to the structural components increases the seismic forces in or strength requirements of any structural component of the existing structure by more than 10 percent cumulative since the original construction, unless the component has the capacity to resist the increased forces determined in accordance with Section 3419. If the building's seismic base shear capacity has been increased since the original construction, the percent change in base shear may be calculated relative to the increased value.

4. Structural elements need repair where the damage has reduced the lateral-load-resisting capacity of the structural system by more than 10 percent.

5. Changes in live or dead load increase story shear by more than 10 percent.

**3417.3.2 Public school buildings.** For public schools, the provisions of Section 3417 apply when required in accordance with Sections 4-307 and 4-309(c), Title 24, Part 1.

**3417.3.3 Community college buildings.** For community colleges, the provisions of Section 3417 apply when required in accordance with Sections 4-307 and 4-309(c), Title 24, Part 1.

**3417.4 Evaluation required.** If the criteria in Section 3417.3 apply to the project under consideration, the design professional of record shall provide an evaluation in accordance with Section 3417 to determine the seismic performance of the building in its current configuration and condition. If the structure's seismic performance as required by Section 3417.5 is evaluated as satisfactory and the peer reviewer(s), when Method B of Section 3421 is used, concur, then no structural retrofit is required.

**3417.5 Minimum seismic design performance levels for structural and nonstructural components.** Following the notations of ASCE 41, the seismic requirements for design and assessment are based upon a prescribed Earthquake Hazard

Level (BSE-1, BSE-2, BSE-R or BSE-C), a specified structural performance level (S-1 through S-5) and a non-structural performance level (N-A through N-E). The minimum seismic performance criteria are given in Table 3417.5 according to the Building Regulatory Authority and the Occupancy Category as determined in Chapter 16 or by the regulatory authority. The building shall be evaluated at both the Level 1 and Level 2 performance levels, and the more restrictive requirements shall apply.

**Exception:** If the floor area of an addition is greater than the larger of 50 per cent of the floor area of the original building or 1,000 square feet (93 m<sup>2</sup>), then the Table 3417.5 entries for BSE-R and BSE-C are replaced by BSE-1 and BSE-2, respectively.

**3417.6 Retrofit required.** Where the evaluation indicates the building does not meet the required performance objectives of this section, the owner shall take appropriate steps to ensure that the building's structural system is retrofitted in accordance with the provisions of Section 3417. Appropriate steps are either: 1) undertake the seismic retrofit as part of the additions, modifications and/or repairs of the structure; or 2) provide a plan, acceptable to the building official, to complete the seismic retrofit in a timely manner. The relocation or moving of an existing building is considered to be an alteration requiring filing of the plans and specifications approved by the building official.

**3417.7** The additions, modification or repair to any existing building are permitted to be prepared in accordance with the requirements for a new building, Chapter 16, Part 2, Title 24, C.C.R., 2007 edition, applied to the entire building.

**3417.8** The requirements of ASCE 41 Chapter 9 are to apply to the use of seismic isolation or passive energy systems for the repair, modification or retrofit of an existing structure. When seismic isolation or passive energy dissipation is used, the project must have project peer review as prescribed in Section 3422.

**TABLE 3417.5**  
**SEISMIC PERFORMANCE REQUIREMENTS BY BUILDING REGULATORY AUTHORITY AND RISK CATEGORY.**  
**ALL BUILDINGS NOT REGULATED BY DSA ARE ASSIGNED AS "STATE-OWNED."**

Building Regulatory Authority	Risk Category	PERFORMANCE CRITERIA	
		Level 1	Level 2
State-Owned	I, II, III	BSE-R, S-3, N-D	BSE-C, S-5, N-E
State-Owned	IV	BSE-R, S-2, N-B	BSE-C, S-4, N-C
Division of the State Architect - Public schools	I	BSE-I, S-3, N-C	BSE-2, S-5, N-E
Division of the State Architect - Public schools	II, III	BSE-I, S-2, N-C	BSE-2, S-4, N-D
Division of the State Architect - Public schools	IV	BSE-I, S-2, N-C	BSE-2, S-4, N-C
Division of the State Architect - Community college	I, II, III	BSE-R, S-3, N-D	BSE-2, S-5, N-E
Division of the State Architect - Community college	IV	BSE-R, S-2, N-B	BSE-2, S-4, N-C

1. ASCE 41 provides acceptance criteria (e.g.  $m$ , rotation) for Immediate Occupancy (S1), Life Safety (S3), and Collapse Prevention (S5), and specifies that values for S-2 and S-4 are to be determined by interpolation between the adjacent performance level values.

The required method of interpolation is as follows:

For level S-2, the acceptance value is  $\frac{1}{3}$  of the sum of the tabulated value for Immediate Occupancy (IO level) and twice the tabulated value for the Life Safety (LS level).

For level S-4, the acceptance value is one-half the sum of the value for the LS level and the value for the Collapse Prevention (CP) level.

For nonstructural components, N-A corresponds to the IO level, N-C to the LS level, and N-D to the Hazards Reduced (HR level).

For evaluation procedures, N-B shall be the same as for N-A. Where numerical values are used, the values for N-B are one half the sum of the appropriate IO and LS values. Where IO or CP values are not given by ASCE 41, then the LS values are permitted to be substituted.

2. Buildings evaluated and retrofitted to meet the requirements for a new building, Chapter 16, Part 2, Title 24, in accordance with the exception in Section 3419.1, are deemed to meet the seismic performance requirements of this section.

**3417.9** Any construction required by this chapter shall include structural observation by the registered design professional who is responsible for the structural design in accordance with Section 3419.10.

**3417.10** Where Method B of Section 3421 is used or is required by Section 3419.7, the proposed method of building evaluation and design procedures must be accepted by the building official prior to the commencement of the work.

**3417.11 Voluntary lateral-force-resisting system modifications.** Where the exception of Section 3417.2 applies, modifications of existing structural components and additions of new structural components that are initiated for the purpose of improving the seismic performance of an existing structure and that are not required by other portions of this chapter are permitted under the requirements of Section 3419.12.

## SECTION 3418 DEFINITIONS

**3418.1.** In addition to the definitions given in Section 3402, for the purposes of Sections 3417 through 3423, certain terms are defined as follows:

**ADDITION** means any work that increases the floor or roof area or the volume of enclosed space of an existing building, and is structurally attached to the existing building by connections that are required for transmitting vertical or horizontal loads between the addition and the existing structure.

**ALTERATION** means any change within or to an existing building, which does not increase and may decrease the floor or roof area or the volume of enclosed space.

**BSE-C RESPONSE ACCELERATION PARAMETERS** are the parameters (SXS and SX1) as determined either: according to ASCE 41, Section 1.6.1.3 for a mean return period PR

equal to 975 years; or by a Site Specific Response Spectrum developed according to ASCE 41, Section 1.6.2 for an Earthquake Hazard Level of 5-percent/50-years probability of exceedance, equivalent to a mean return period of 975 years.

**BSE-R RESPONSE ACCELERATION PARAMETERS** are the parameters (SXS and SX1) as determined either: according to ASCE 41, Section 1.6.1.3 for a mean return period PR equal to 225 years; or by a Site Specific Response Spectrum developed according to ASCE 41, Section 1.6.2 for an Earthquake Hazard Level of 20-percent /50-years probability of exceedance, equivalent to a mean return period of 225 years.

**BUILDING OFFICIAL** is that individual within the agency or organization charged with responsibility for compliance with the requirements of this code. For some agencies this person is termed the "enforcement agent."

**DESIGN** is the procedure that includes both the evaluation and retrofit design of an existing component, element or structural system, and design of a new component, element or structural system.

**ENFORCEMENT AGENCY (Authority Having Jurisdiction in ASCE 41)** is the agency or organization charged with responsibility for agency or organization compliance with the requirements of this code.

**METHOD A** refers to the procedures prescribed in Section 3420.

**METHOD B** refers to the procedures allowed in Section 3421.

**MODIFICATIONS.** For this chapter, modification is taken to include repairs to structures that have been damaged.

**N-A, N-B, N-C, N-D, N-E** are seismic nonstructural component performance measures as defined in ASCE 41. N-A corresponds to the highest performance level, and N-D the lowest, while N-E is not considered.



**PEER REVIEW** refers to the procedures contained in Section 3422.

**REPAIR** as used in this chapter means the design and construction work undertaken to restore or enhance the structural and nonstructural load-resisting system participating in the lateral response and stability of a structure that has experienced damage from earthquakes or other destructive events.

**S-1, S-2, S-3, S-4, S-5, S-6** are seismic structural performance measures as defined in ASCE 41. S-1 corresponds to the highest performance level, and S-5 the lowest, while S-6 is not considered.

**SPECIFIC PROCEDURES** are the procedures listed in Section 3419.1.1.

**STRUCTURAL REPAIRS** are any changes affecting existing or requiring new structural components primarily intended to correct the effects of damage, deterioration or impending or actual failure, regardless of cause.

## SECTION 3419 SEISMIC CRITERIA SELECTION FOR EXISTING BUILDINGS

**3419.1 Basis for evaluation and design.** This section determines what technical approach is to be used for the seismic evaluation and design for existing buildings. For those buildings or portions of buildings for which Section 3417 requires action, the procedures and limitations for the evaluation of existing buildings and design of retrofit systems and/or repair thereof shall be implemented in accordance with this section.

One of the following approaches must be used:

1. Method A of Section 3420;
2. Method B of Section 3421, with independent review of a peer reviewer as required in Section 3422; or
3. For state-owned buildings only, the use of one of the specific procedures listed in Section 3419.1.1.

When Method B is chosen it must be approved by the building official, and, where applicable, by the peer reviewer. All referenced standards in ASCE 41 shall be replaced by referenced standards listed in Chapter 35 of this code.

**Exception: [DSA-SS & DSA-SS/CC]** For public schools and community colleges constructed to the requirements of California Building Code, 2007 or later edition, that code is permitted to be used in place of those specified in Section 3419.1 provided the building complies with Seismic Design Category D or higher.

**3419.1.1 Specific procedures.** For state-owned buildings, the following specific procedures taken from the International Existing Building Code (IEBC) Appendix A may be used, without peer review, for their respective types of construction to comply with the seismic performance requirements for Risk Category I, II or III buildings:

1. Seismic Strengthening Provisions for Unreinforced Masonry Bearing Wall Buildings (Chapter A1 of the IEBC).

2. Prescriptive Provisions for Seismic Strengthening of Cripple Walls and Sill Plate Anchorage of Light Wood-Frame, Residential Buildings (Chapter A3 of the IEBC).
3. Earthquake Hazard Reduction in Existing Reinforced Concrete and Reinforced Masonry Wall Buildings with Flexible Diaphragms (Chapter A2 of the IEBC).

**3419.1.2** When a design project is begun under Method B the selection of the peer reviewer is subject to the approval of the building official. Following approval by the peer reviewer, the seismic criteria for the project and the planned evaluation provisions must be approved by the building official. The approved seismic criteria and evaluation provisions shall apply. Upon approval of the building official these are permitted to be modified.

**3419.1.3** For state-owned and community college buildings, where unreinforced masonry is not bearing, it may be used only to resist applied lateral loads. Where unreinforced masonry walls are part of the structure they must be assessed for stability under the applicable nonstructural evaluation procedure.

**3419.1.4 Public schools.** For public schools, unreinforced masonry shall not be used to resist in-plane or out-of-plane seismic forces or superimposed gravity loads.

**3419.1.5 Public schools.** For public schools of light-frame construction, horizontal diaphragms and vertical shear walls shall consist of either diagonal lumber sheathing or structural panel sheathing. Braced horizontal diaphragms may be acceptable when approved by DSA. Straight lumber sheathing may be used in combination with diagonal or structural panel sheathing as diaphragms or shear walls. Let-in bracing, plaster (stucco), hollow claytile, gypsum wallboard and particleboard sheathing shall not be assumed to resist seismic forces.

**3419.2 Existing conditions.** The existing condition and properties of the entire structure must be determined and documented by thorough inspection of the structure and site, review of all available related construction documents, review of geotechnical and engineering geologic reports, and performance of necessary testing and investigation. Where samples from the existing structure are taken or in situ tests are performed, they shall be selected and interpreted in a statistically appropriate manner to ensure that the properties determined and used in the evaluation or design are representative of the conditions and structural circumstances likely to be encountered in the structure as a whole. Adjacent structures or site features that may affect the retrofit design shall be identified.

The entire load path of the seismic-force-resisting system shall be determined, documented and evaluated. The load path includes all the horizontal and vertical elements participating in the structural response: such as diaphragms, diaphragm chords, diaphragm collectors, vertical elements such as walls frames, braces; foundations and the connections between the components and elements of the load path. Repaired or retrofitted elements and the standards under which the work was constructed shall be identified.

Data collection in accordance with ASCE 41 Section 2.2 shall meet the following minimum levels:

1. For state-owned buildings, the requirements shall be met following the data collection requirements of ASCE 41, Section 2.2.
2. For public schools and community college buildings constructed in conformance with the Field Act, the “Usual” level as defined in ASCE 41, Section 2.2.6.2.
3. For public schools and community college buildings not constructed in conformance with the Field Act, the “Comprehensive” level as defined in ASCE 41, Section 2.2.6.3.

Concrete material requirements and testing for public school and community college buildings shall also comply with Sections 1914A and 1913.5, respectively.

Qualified test data from the original construction may be accepted, in part or in whole, by the enforcement agency to fulfill the data collection requirements.

**Exceptions:**

1. The number of samples for data collection may be adjusted with approval of the enforcement agency when it has been determined that adequate information has been obtained or additional information is required.
2. Welded steel moment frame connections of buildings that may have experienced potentially damaging ground motions shall be inspected in accordance with Chapters 3 and 4, FEMA 352, Recommended Post Earthquake Evaluation and Repair Criteria for Welded Moment-Frame Construction for Seismic Applications (July 2000).

Where original building plans and specifications are not available, “as-built” plans shall be prepared that depict the existing vertical and lateral structural systems, exterior elements, foundations and nonstructural systems in sufficient detail to complete the design.

Data collection shall be directed and observed by the project structural engineer or design professional in charge of the design.

**3419.3 Site geology and soil characteristics.** Soil profile shall be assigned in accordance with the requirements of Chapter 18.

**3419.4 Risk categories.** For purposes of earthquake-resistant design, each structure shall be placed in one of the risk categories in accordance with the requirements of this code.

**3419.5 Configuration requirements.** Each structure shall be designated structurally regular or irregular in accordance with the requirements of ASCE 41, Sections 2.4.1.1.1. to 2.4.1.1.4.

**3419.6 General selection of the design method.** The requirements of Method B (Section 3421) may be used for any existing building.

**3419.7 Prescriptive selection of the design method.** The requirements of Method A (Section 3420) or the specific procedures for applicable building types given in Section 3419.1.1

are permitted to be used except under the following conditions, where the requirements of Method B (Section 3421) must be used.

**3419.7.1** When the building contains prestressed or post-tensioned structural components (beams, columns, walls or slabs) or contains precast structural components (beams, columns, walls or flooring systems).

**3419.7.2** When the building is classified as irregular in vertical or horizontal plan by application of ASCE/SEI 7, Section 12.3 and/or ASCE 41, Sections 2.4.1.1.1 to 2.4.1.1.4, unless the irregularity is demonstrated not to affect the seismic performance of the building.

**Exception:** If the retrofit design removes the configurational attributes that caused the building to be classified as irregular, then Section 3419.7.2 does not apply and Method A may be used.

**3419.7.3** For any building that is assigned to Risk Category IV.

**3419.7.4** For any building using undefined or hybrid structural systems.

**3419.7.5** When seismic isolation or energy dissipation systems are used in the retrofit or repair, either as part of the existing structure or as part of the modifications.

**3419.7.6** When the height of the structure exceeds 240 feet (73 152 mm).

**3419.8 Strength requirements.** All components of the lateral-force-resisting system must have the strength to meet the acceptance criteria prescribed in ASCE 41, Chapter 3, or as prescribed in the applicable Appendix A chapter of the IEBC if a specific procedure in Section 3419.1.1 is used. Any component not having this strength shall have its capacity increased by modifying or supplementing its strength so that it exceeds the demand, or the demand is reduced to less than the existing strength by making other modifications to the structural system.

**Exception:** A component’s strength is permitted to be less than that required by the specified seismic load combinations if it can be demonstrated that the associated reduction in seismic performance of the component or its removal due to the failure does not result in a structural system that does not comply with the required performance objectives of Section 3417. If this exception is taken for a component, then it cannot be considered part of the primary lateral-load-resisting system.

**3419.9 Nonstructural component requirements.** Where the nonstructural performance levels required by Section 3417, Table 3417.5 are N-D or higher, mechanical, electrical and plumbing components shall comply with the provisions of ASCE 41, Chapter 11, Section 11.2.

**Exception:** Modifications to the procedures and criteria may be made subject to approval by the building official, and concurrence of the peer reviewer if applicable. All reports and correspondence shall also be forwarded to the building official.

**3419.10 Structural observation, testing and inspection.**

Structural, geotechnical and construction observation, testing and inspection as used in this section shall mean meeting the requirements of Chapter 17, with a minimum allowable level of investigation corresponding to seismic design category (SDC) D. At a minimum the project site will be visited by the responsible design professional to observe existing conditions and to review the construction work for general compliance with approved plans, specifications and applicable structural regulations. Such visits shall occur at significant construction stages and at the completion of the structural retrofit. Structural observation shall be provided for all structures. The plan for testing and inspection shall be submitted to the building official for review and approval with the application for permit.

**Additional requirements:** For public schools and community colleges, construction material testing, inspection and observation during construction shall also comply with Section 4-333, Part 1, Title 24.

**3419.10.1** The registered design professional, or their designee, responsible for the structural design shall be retained to perform structural observation and independently report to the owner of observations and findings as they relate to adherence to the permitted plans and good workmanship.

**3419.10.2** At the conclusion of construction, the structural observer shall submit to the enforcement agency and the owner a final written statement that the required site visits have been made, that the work, to the best of the structural observers knowledge and belief, is or is not in general conformity to the approved plans and that the observed structural deficiencies have been resolved and/or listing those that, to the best of the structural observers knowledge and belief, have not been satisfactorily corrected.

**3419.10.2.1** The requirement for structural observation shall be noted and prominently displayed on the front sheet of the approved plans and incorporated into the general notes on the approved plans.

**3419.10.2.2 Preconstruction meeting.** A preconstruction meeting is mandatory for all projects which require structural observation. The meeting shall include, but is not limited to, the registered design professional, structural observer, general constructor, affected subcontractors, the project inspector and a representative of the enforcement agency (designated alternates may attend if approved by the structural observer). The structural observer shall schedule and coordinate this meeting. The purpose of the meeting is to identify and clarify all essential structural components and connections that affect the lateral and vertical load systems and to review scheduling of the required observations for the project's structural system retrofit.

**3419.11 Temporary actions.** When compatible with the building use, and the time phasing for both use and the retrofit program, temporary shoring or other structural support is permitted to be considered. Temporary bracing, shoring and prevention of falling hazards are permitted to be used to qualify for Exception 1 in Section 3419.12 that allows inadequate

capability in some existing components, as long as the required performance levels given in Section 3417 can be provided by the permanent structure. The consideration for such temporary actions shall be noted in the design documents. ||

**3419.12 Voluntary modifications to the lateral-force resisting system.** Where modifications of existing structural components and additions of new structural components are initiated for the purpose of improving the lateral-force resisting strength or stiffness of an existing structure and they are not required by other sections of this code, then they are permitted to be designed to meet an approved seismic performance criteria provided that an engineering analysis is submitted that follows:

1. The capacity of existing structural components required to resist forces is not reduced, unless it can be demonstrated that reduced capacity meets the requirements of Section 3419.8.
2. The lateral loading to or strength requirement of existing structural components is not increased beyond their capacity.
3. New structural components are detailed and connected to the existing structural components as required by this code for new construction.
4. New or relocated nonstructural components are detailed and connected to existing or new structural components as required by this code for new construction.
5. A dangerous condition is not created.

**3419.12.1 State-owned buildings.** Voluntary modifications to lateral-force-resisting systems conducted in accordance with Appendix A of the IEBC and the referenced standards of this code shall be permitted.

**3419.12.1.1 Design documents.** When Section 3419.12 is the basis for structural modifications, the approved design documents must clearly state the scope of the seismic modifications and the accepted criteria for the design. The approved design documents must clearly have the phrase "The seismic requirements of Chapter 34 for existing buildings have not been checked to determine if these structural modifications meet CBC requirements: the modifications proposed are to a different seismic performance standard than would be required in Section 3419 if they were not voluntary as allowed in Section 3419.12."

**3419.12.2 Public schools and community colleges.** When Section 3419.12 is the basis for structural modifications, the approved design documents must clearly indicate the scope of modifications and the acceptance criteria for the design.

## SECTION 3420 METHOD A

**3420.1 General.** The retrofit design shall employ the Linear Static or Linear Dynamic Procedures of ASCE 41, Section 3.3.1 or 3.3.2, and comply with the applicable general requirements of ASCE 41, Chapters 2 and 3. The earthquake hazard level and performance level given specified in Section 3417.5 for the building's risk category shall be used. Structures shall ||



be designed for seismic forces coming from any horizontal direction.

**Exception:** The ASCE 41 Simplified Rehabilitation Method of Chapter 10 may be used if the Level 1 seismic performance level is S-3 or lower, the building's structural system is one of the primary building types described in ASCE 41, Table 10-2, and ASCE 41, Table 10-1 permits its use for the building height.

## SECTION 3421 METHOD B

**3421.1** The existing or retrofitted structure shall be demonstrated to have the capability to sustain the deformation response due to the specified earthquake ground motions and meet the seismic performance requirements of Section 3417. The registered design professional shall provide an evaluation of the response of the existing structure in its modified configuration and condition to the ground motions specified. If the building's seismic performance is evaluated as satisfactory and the peer reviewer(s) and the enforcement agency concurs, then no further structural modifications of the lateral-load-resisting system are required.

When the evaluation indicates the building does not meet the required performance levels given in Table 3417.5 for the risk category, then a retrofit and/or repair design shall be prepared that provides a structure that meets these performance objectives and reflects the appropriate consideration of existing conditions. Any approach to analysis and design is permitted to be used, provided that the approach shall be rational, shall be consistent with the established principals of mechanics and shall use the known performance characteristics of materials and assemblages under reversing loads typical of severe earthquake ground motions.

**Exception:** Further consideration of the structure's seismic performance may be waived by the enforcement agency if both the registered design professional and peer reviewer(s) conclude that the structural system can be expected to perform at least as well as required by the provisions of this section without completing an analysis of the structure's compliance with these requirements. A detailed report shall be submitted to the responsible building official that presents the reasons and basis for this conclusion. This report shall be prepared by the registered design professional. The peer reviewer(s) shall concur in this conclusion and affirm to it in writing. The building official shall either approve this decision or require completion of the indicated work specified in this section prior to approval.

**3421.2** The approach, models, analysis procedures, assumptions on material and system behavior and conclusions shall be peer reviewed in accordance with the requirements of Section 3422 and accepted by the peer reviewer(s).

### Exceptions:

1. The enforcement agency may perform the work of peer review when qualified staff is available within the jurisdiction.

2. The enforcement agency may modify or waive the requirements for peer review when appropriate.

**3421.2.1** The approach used in the development of the design shall be acceptable to the peer reviewer and the enforcement agency and shall be the same method as used in the evaluation of the building. Approaches that are specifically tailored to the type of building, construction materials and specific building characteristics may be used, if they are acceptable to the independent peer reviewer. The use of Method A allowed procedures may also be used under Method B.

**3421.2.2** Any method of analysis may be used, subject to acceptance by the peer reviewer(s) and the building official. The general requirements given in ASCE 41, Chapter 2, shall be complied with unless exceptions are accepted by the peer reviewer(s) and building official. Use of other than ASCE 41 procedures in Method B requires building official concurrence before implementation.

**3421.2.3** Prior to implementation, the procedures, methods, material assumptions and acceptance/rejection criteria proposed by the registered design professional will be peer reviewed as provided in Section 3422. Where nonlinear procedures are used, prior to any analysis, the representation of the seismic ground motion shall be reviewed and approved by the peer reviewer(s) and the building official.

**3421.2.4** The conclusions and design decisions shall be reviewed and accepted by the peer reviewer(s) and the building official.

## SECTION 3422 PEER REVIEW REQUIREMENTS

**3422.1 General.** Independent peer review is an objective, technical review by knowledgeable reviewer(s) experienced in the structural design, analysis and performance issues involved. The reviewer(s) shall examine the available information on the condition of the building, the basic engineering concepts employed and the recommendations for action.

**3422.2 Timing of independent review.** The independent reviewer(s) shall be selected prior to initiation of substantial portions of the design and/or analysis work that is to be reviewed, and review shall start as soon as practical after Method B is adopted and sufficient information defining the project is available.

**3422.3 Qualifications and terms of employment.** The reviewer(s) shall be independent from the design and construction team.

**3422.3.1** The reviewer(s) shall have no other involvement in the project before, during or after the review, except in a review capacity.

**3422.3.2** The reviewer(s) shall be selected and paid by the owner and shall have technical expertise in the evaluation and retrofit of buildings similar to the one being reviewed, as determined by the enforcement agency.

**3422.3.3** The reviewer (or in the case of review teams, the chair) shall be a California-licensed structural engineer



who is familiar with the technical issues and regulations governing the work to be reviewed.

**Exception:** Other individuals with acceptable qualifications and experience may be a peer reviewer(s) with the approval of the building official.

**3422.3.4** The reviewer shall serve through completion of the project and shall not be terminated except for failure to perform the duties specified herein. Such termination shall be in writing with copies to the enforcement agency, owner and the registered design professional. When a reviewer is terminated or resigns, a qualified replacement shall be appointed within 10 working days, and the reviewer shall submit copies of all reports, notes and correspondence to the responsible building official, the owner and the registered design professional within 10 working days of such termination.

**3422.3.5** The peer reviewer shall have access in a timely manner to all documents, materials and information deemed necessary by the peer reviewer to complete the peer review.

**3422.4 Scope of review.** Review activities shall include, where appropriate, available construction documents, design criteria and representative observations of the condition of the structure, all inspection and testing reports, including methods of sampling, analytical models and analyses prepared by the registered design professional and consultants, and the retrofit or repair design. Review shall include consideration of the proposed design approach, methods, materials, details and constructability.

Changes observed during construction that affect the seismic-resisting system shall be reported to the reviewer in writing for review and recommendation.

**3422.5 Reports.** The reviewer(s) shall prepare a written report to the owner and building official that covers all aspects of the review performed, including conclusions reached by the reviewer(s). Reports shall be issued after the schematic phase, during design development, and at the completion of construction documents but prior to submittal of the project plans to the enforcement agency for plan review. When acceptable to the building official, the requirement for a report during a specific phase of the project development may be waived.

Such reports should include, at the minimum, statements of the following:

1. Scope of engineering design peer review with limitations defined.
2. The status of the project documents at each review stage.
3. Ability of selected materials and framing systems to meet performance criteria with given loads and configuration.
4. Degree of structural system redundancy and the deformation compatibility among structural and nonstructural components.
5. Basic constructability of the retrofit or repair system.
6. Other recommendations that would be appropriate to the specific project.

7. Presentation of the conclusions of the reviewer identifying any areas that need further review, investigation and/or clarification.

8. Recommendations.

The last report prepared prior to submittal of permit documents to the enforcement agency shall include a statement indicating that the design is in conformance with the approved evaluation and design criteria

**3422.6 Response and resolutions.** The registered design professional shall review the report from the reviewer(s) and shall develop corrective actions and responses as appropriate. Changes observed during construction that affect the seismic-resisting system shall be reported to the reviewer in writing for review and recommendations. All reports, responses and resolutions prepared pursuant to this section shall be submitted to the responsible enforcement agency and the owner along with other plans, specifications and calculations required. If the reviewer resigns or is terminated prior to completion of the project, then the reviewer shall submit copies of all reports, notes and correspondence to the responsible building official, the owner and the registered design professional within 10 working days of such termination.

**3422.7 Resolution of conflicts.** When the conclusions and recommendations of the peer reviewer conflict with the registered design professional's proposed design, the enforcement agency shall make the final determination of the requirement for the design.

## SECTION 3423 ADDITIONAL REQUIREMENTS FOR PUBLIC SCHOOLS AND COMMUNITY COLLEGES

The requirements of Section 3423 apply only to public schools under the jurisdiction of the Division of the State Architect-Structural Safety (DSA-SS, refer to Section 1.9.2.1) and community colleges under the jurisdiction of the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC). Refer to Section 1.9.2.2.

**3423.1 Evaluation and design criteria report.** During the schematic phase of the project, the owner or the registered design professional in charge of the design shall prepare and sign an Evaluation and Design Criteria Report in accordance with Part 1, Title 24, C. C. R., Section 4-307(a). The report shall be submitted to the DSA for review and approval prior to proceeding with design development of the rehabilitation.

The Evaluation and Design Criteria Report shall:

1. Identify the building(s) structural and nonstructural systems, potential deficiencies in the elements or systems and the proposed method for retrofit.
2. Identify geological and site-related hazards.
3. Propose the methodology for evaluation and retrofit design.
4. Propose the complete program for data collection (Section 3419.2).

5. Include existing or “as-built” building plans, reports and associated documents of the existing construction.

### **3423.2 Rehabilitation involving only portions of structures.**

Where only a portion(s) of a structure is to be rehabilitated, the public school or community college portion of the structure shall:

1. Be seismically separated from the unrehabilitated portion in accordance with Chapter 16 of Part 2, Title 24, or the entire structure shall be rehabilitated in accordance with this Section. For structures in which the unrehabilitated portion is above or below the school or community college portion, the entire structure shall be rehabilitated in accordance with this division.
2. Be retrofitted as necessary to protect the occupants from falling hazards of the unrehabilitated portion of the building, and;
3. Be retrofitted as necessary to protect required exitways being blocked by collapse or falling hazards of the unrehabilitated portion.

## **SECTION 3424 ADDITIONAL REQUIREMENTS FOR SKILLED NURSING FACILITIES AND INTERMEDIATE CARE FACILITIES [OSHDP 2]**

**3424.1 Services/systems and utilities.** Services/systems and utilities that are necessary to the operation of a skilled nursing facility or intermediate care facility shall meet the requirements of this section. Examples of services/systems and utilities include but are not limited to normal power; emergency power; nurse call; fire alarm; communication and data systems; space-heating systems; process load systems; cooling systems; domestic hot and cold water systems; means of egress systems; fire-suppression systems; building drain and sewer systems; and medical gas systems that support licensed services.

**Exception:** Remodel projects that use available existing services/systems and utilities are exempted from the requirements of this section. The enforcing agency may exempt minor addition, minor alteration, and minor remodel projects and projects to upgrade existing services/systems and utilities from the requirements of this section.

**3424.1.1 Services/systems and utilities for skilled nursing facilities and intermediate care facilities.**

**3424.1.1.1 New buildings and additions.** Services/systems and utilities for new buildings and additions shall not originate in or pass through or under nonconforming structures. The structures must be under the jurisdiction of OSHPD.

**Exception:** As an alternate to this section, skilled nursing and intermediate care facilities may meet the requirements in Section 3416A.1.1.1 for hospital buildings.

**3424.1.1.2 Alterations and remodels.** Services/systems and utilities for alterations or remodels of existing buildings may pass through nonconforming structures provided that the structure is under the jurisdiction of OSHPD, and the new services/systems and utilities passing through the buildings are anchored and braced for seismic forces in accordance with these regulations for new buildings and are free of adverse seismic interactions caused by potential failure of overhead or adjacent components.

**3424.2 Means of egress for single-story light frame skilled nursing facilities and intermediate care facilities.** Means of egress for single-story light frame skilled nursing facilities and intermediate care facilities shall comply with the requirements of Sections 3424.2.1 and 3424.2.2.

### **3424.2.1 New facilities or additions to existing facilities.**

Means of egress for new skilled nursing facilities or intermediate care facilities, or additions to existing skilled nursing facilities or intermediate care facilities shall only pass through conforming buildings.

**Exception:** As an alternate, the nursing facilities and intermediate care facilities may meet the egress requirements in Sections 3417A.1.1.1.1 through 3417A.1.1.1.5 for hospital buildings.

**3424.2.2 Jurisdiction.** Means of egress for skilled nursing facilities and intermediate care facilities shall only pass through buildings that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).



## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER 34A – EXISTING STRUCTURES

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter									X			X								
Adopt entire chapter as amended (amended sections listed below)																				
Adopt only those sections that are listed below																				
Chapter/Section																				



## CHAPTER 34A

# EXISTING STRUCTURES

### SECTION 3401A GENERAL

**3401A.1 Scope.** The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing structures *for applications listed in Sections 1.10.1 (OSHDP 1) and 1.10.4 (OSHDP 4) regulated by the Office of Statewide Health Planning and Development (OSHDP).*

*These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers. For SFM and DSA-AC requirements enforced by the Office of Statewide Health Planning and Development (OSHDP) refer to Chapter 34.*

**Exception:** [OSHDP 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725, which shall comply with Chapter 34 and any applicable amendments therein.*

**[DSA-AC]** *For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance for accessibility requirements, see Chapter 11B, Section 1134B.*

**3401A.2 Maintenance.** Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or safeguards which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. To determine compliance with this subsection, the building official shall have the authority to require a building or structure to be reinspected. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures.

**3401A.3 Compliance.** Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, in the *California Energy Code, California Fire Code, California Mechanical Code, California Plumbing Code and California Electrical Code, California Residential Code and NFPA 70*. Where provisions of the other codes conflict with provisions of this chapter, the provisions of this chapter shall take precedence.

**3401A.4 Building materials and systems.** Building materials and systems shall comply with the requirements of this section.

**3401A.4.1 Existing materials.** Materials already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the building official to be unsafe per Section 116.

**3401A.4.2 New and replacement materials.** Except as otherwise required or permitted by this code, materials per-

mitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

**3401A.4.3 Existing seismic force-resisting systems.** Where the existing seismic force-resisting system is a type that can be designated ordinary or is a welded steel moment frame constructed under a permit issued prior to October 25, 1994, values of  $R$ ,  $\Omega_0$ , and  $C_d$  for the existing seismic force-resisting system shall be those specified by this code for an ordinary system unless it is demonstrated that the existing system will provide performance equivalent to that of a detailed, intermediate or special system.

**3401.5 Dangerous conditions.** The building official shall have the authority to require the elimination of conditions deemed dangerous.

### SECTION 3402A DEFINITIONS

**3402A.1 Definitions.** The following terms are defined in Chapter 2.

**DANGEROUS.**

**PRIMARY FUNCTION.**

**SUBSTANTIAL STRUCTURAL DAMAGE.**

**TECHNICALLY INFEASIBLE.**

**3402A.2 Definitions for this chapter.** The following words and terms shall, for the purposes of this chapter and as used elsewhere in the code, have the meanings shown herein. *Definitions provided in Section 1613A.2, ASCE 7 Section 11.2 and ASCE 41 shall apply when appropriate in addition to terms defined in this section:*

**ASSOCIATED STRUCTURAL ALTERATIONS** means any change affecting existing structural elements or requiring new structural elements for vertical or lateral support of an otherwise nonstructural alteration.

**EXISTING STRUCTURE.** A structure that has a valid certificate of occupancy issued by the building official.

**GENERAL ACUTE CARE HOSPITAL.** See Section 1224.3.

**NONSTRUCTURAL ALTERATION** is any alteration which neither affects existing structural elements nor requires new structural elements for vertical or lateral support and which does not increase the lateral shear force in any story by more than 5 percent.

**PEER REVIEW** refers to procedure contained in Section 3414A.



**REPAIR** as used in this chapter means all the design and construction work affecting existing or requiring new structural elements undertaken to restore or enhance the structural and nonstructural load resisting system participating in vertical or lateral response of a structure primarily intended to correct the effects of deterioration or impending or actual failure, regardless of cause.

**VOLUNTARY STRUCTURAL ALTERATION** is any alteration of existing structural element or provision of new structural elements which is not necessary for vertical or lateral support of other work and is initiated by the applicant primarily for the purpose of increasing the vertical or lateral load-carrying strength or stiffness of an existing building.

### SECTION 3403A ADDITIONS

**3403A.1 General.** Additions to any building or structure shall comply with the requirements of this code for new construction. Alterations to the existing building or structure shall be made to ensure that the existing building or structure together with the addition are no less conforming with the provisions of this code than the existing building or structure was prior to the addition. An existing building together with its additions shall comply with the height and area provisions of Chapter 5.

**3403A.2 Flood hazard areas.** For buildings and structures in flood hazard areas established in Section 1612A.3, any addition that constitutes substantial improvement of the existing structure, as defined in Section 1612A.2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612A.3, any additions that do not constitute substantial improvement of the existing structure, as defined in Section 1612A.2, are not required to comply with the flood design requirements for new construction.

**3403A.3 Existing structural elements carrying gravity load.** Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased load required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased shall be considered an altered element subject to the requirements of Section 3404A.3. Any existing element that will form part of the lateral load path for any part of the addition shall be considered an existing lateral load-carrying structural element subject to the requirements of Section 3403A.4.

**3403A.3.1 Design live load.** Where the addition does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the addition. If the approved live load is less than that required by Section 1607A, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the addition does

result in increased design live load, the live load required by Section 1607A shall be used.

#### **3403A.4 Existing structural elements carrying lateral load.**

Where the addition is structurally independent of the existing structure, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the addition is not structurally independent of the existing structure, the existing structure and its addition acting together as a single structure shall be shown to meet the requirements of Sections 1609A and 1613A.

#### **Exceptions:**

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the addition considered is no more than 10 percent greater than its demand-capacity ratio with the addition ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609A and 1613A. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.
2. For incidental alterations, drift limits based on original design code shall be permitted to be used in lieu of the drift limits required by ASCE 7.

#### **3403A.5 Smoke alarms in existing portions of a building.**

Where an addition is made to a building or structure of a Group R or I-1 occupancy, the existing building shall be provided with smoke alarms in accordance with Section 1103A.8 of the California Fire Code.

### SECTION 3404A ALTERATIONS

**3404A.1 General.** Except as provided by this section, alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less complying with the provisions of this code than the existing building or structure was prior to the alteration.

#### **Exceptions:**

1. An existing stairway shall not be required to comply with the requirements of Section 1009 where the existing space and construction does not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with Section 1009.15 shall not be required to comply with the requirements of Section 1012.6 regarding full extension of the handrails where such extensions would be hazardous due to plan configuration.

**3404A.2 Flood hazard areas.** For buildings and structures in flood hazard areas established in Section 1612A.3, any alteration that constitutes substantial improvement of the existing structure, as defined in Section 1612A.2, shall comply with the flood design requirements for new construction, and all aspects

of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612A.3, any alterations that do not constitute substantial improvement of the existing structure, as defined in Section 1612A.2, are not required to comply with the flood design requirements for new construction.

**3404A.3 Existing structural elements carrying gravity load.** Any existing gravity load-carrying structural element for which an alteration causes an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the alteration shall be shown to have the capacity to resist the applicable design gravity loads required by this code for new structures.

**3404A.3.1 Design live load.** Where the alteration does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the alteration. If the approved live load is less than that required by Section 1607A, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the alteration does result in increased design live load, the live load required by Section 1607A shall be used.

**3404A.4 Existing structural elements carrying lateral load.** Except as permitted by Section 3404A.5, where the alteration increases design lateral loads in accordance with Section 1609A or 1613A, or where the alteration results in a structural irregularity as defined in ASCE 7, or where the alteration decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall be shown to meet the requirements of Sections 1609A and 1613A.

#### Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is no more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces per Sections 1609A and 1613A. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces, and capacities shall account for the cumulative effects of additions and alterations since original construction.
2. For incidental alterations, drift limits based on original design code shall be permitted to be used in lieu of the drift limits required by ASCE 7.

**3404A.5 Voluntary seismic improvements.** Alterations to existing structural elements or additions of new structural elements that are not otherwise required by this chapter and are initiated for the purpose of improving the performance of the

seismic force-resisting system of an existing structure or the performance of seismic bracing or anchorage of existing nonstructural elements shall be permitted, provided that an engineering analysis is submitted demonstrating the following:

1. The altered structure, and the altered structural and nonstructural elements are no less in compliance with the provisions of this code with respect to earthquake design than they were prior to the alteration.
2. New structural elements are designed, detailed and connected to the existing structural elements as required by Chapter 16A. *Alterations of existing structural elements shall be based on design demand required by Chapter 16A but need not exceed the maximum load effect that can be transferred to the elements by the system.*
3. New, relocated or altered nonstructural elements are designed, detailed and connected to existing or new structural elements as required by Chapter 16A.
4. The alterations do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

**Exception:** Seismic design in accordance with Sections 3411A and 3412A shall be permitted.

**3404A.6 Smoke alarms.** Individual sleeping units and individual dwelling units in Group R and I-1 occupancies shall be provided with smoke alarms in accordance with Section 1103A.8 of the *California Fire Code*.

## SECTION 3405A REPAIRS

**3405A.1 General.** Buildings and structures, and parts thereof, shall be repaired in compliance with Section 3405A and 3401A.2. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the requirements for alterations in this chapter. Routine maintenance required by Section 3401A.2, ordinary repairs exempt from permit in accordance with Section 105.2, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.

**3405A.2 Substantial structural damage to vertical elements of the lateral force-resisting system.** A building that has sustained substantial structural damage to the vertical elements of its lateral force-resisting system shall be evaluated and repaired in accordance with the applicable provisions of Sections 3405A.2.1 through 3405A.2.3.

#### Exceptions:

1. Buildings assigned to Seismic Design Category A, B, or C whose substantial structural damage was not caused by earthquake need not be evaluated or rehabilitated for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or rehabilitated for load combinations that include earthquake effects.



**3405A.2.1 Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the building official. The evaluation shall establish whether the damaged building, if repaired to its pre-damage state, would comply with the provisions of this code for wind and earthquake loads.

Wind loads for this evaluation shall be those prescribed in Section 1609A. Earthquake loads for this evaluation, if required, shall be permitted to be 75 percent of those prescribed in Section 1613A. *Where the existing seismic force-resisting system is a type that can be designated ordinary or is a welded steel moment frame constructed under a permit issued prior to October 25, 1994, values of  $R$ ,  $\phi$  and  $C_d$  for the existing seismic force-resisting system shall be those specified by this code for an ordinary system unless it is demonstrated that the existing system will provide performance equivalent to that of an intermediate or special system.*

**3405A.2.2 Extent of repair for compliant buildings.** If the evaluation establishes compliance of the pre-damage building in accordance with Section 3405A.2.1, then repairs shall be permitted that restore the building to its pre-damage state, based on material properties and design strengths applicable at the time of original construction.

**3405A.2.3 Extent of repair for noncompliant buildings.** If the evaluation does not establish compliance of the predamage building in accordance with Section 3405A.2.1, then the building shall be rehabilitated to comply with applicable provisions of this code for load combinations, including wind or seismic loads. The wind loads for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be as required by the code in effect at the time of original construction or as required by this code. Earthquake loads for this rehabilitation design shall be those required for the design of the predamage building, but not less than *ninety* percent of those prescribed in Section 1613A. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

**3405A.3 Substantial structural damage to gravity load-carrying components.** Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions of this code for dead and live loads. Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects. Existing gravity load-carrying structural elements shall be permitted to be designed for live loads approved prior to the damage. Nondamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated or shown to have the capacity to carry the design loads of the rehabilitation design. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

**3405A.3.1 Lateral force-resisting elements.** Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to gravity load-carrying components was caused primarily by wind or earthquake effects, then the building shall be evaluated in accordance with Section 3405A.2.1 and, if noncompliant, rehabilitated in accordance with Section 3405A.2.3.

**3405A.4 Less than substantial structural damage.** For damage less than substantial structural damage, repairs shall be allowed that restore the building to its pre-damage state, based on material properties and design strengths applicable at the time of original construction. New structural members and connections used for this repair shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

**3405A.5 Flood hazard areas.** For buildings and structures in flood hazard areas established in Section 1612A.3, any repair that constitutes substantial improvement of the existing structure, as defined in Section 1612A.2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612A.3, any repairs that do not constitute substantial improvement or repair of substantial damage of the existing structure, as defined in Section 1612A.2, are not required to comply with the flood design requirements for new construction.

## SECTION 3406A FIRE ESCAPES

**3406A.1 Where permitted.** Fire escapes shall be permitted only as provided for in Sections 3406A.1.1 through 3406A.1.4.

**3406A.1.1 New buildings.** Fire escapes shall not constitute any part of the required means of egress in new buildings.

**3406A.1.2 Existing fire escapes.** Existing fire escapes shall be continued to be accepted as a component in the means of egress in existing buildings only.

**3406A.1.3 New fire escapes.** New fire escapes for existing buildings shall be permitted only where exterior stairs cannot be utilized due to lot lines limiting stair size or due to the sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

**3406A.1.4 Limitations.** Fire escapes shall comply with this section and shall not constitute more than 50 percent of the required number of exits nor more than 50 percent of the required *exit* capacity.

**3406A.2 Location.** Where located on the front of the building and where projecting beyond the building line, the lowest landing shall not be less than 7 feet (2134 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counter-balanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall not be less than 12 feet (3658 mm).

**3406A.3 Construction.** The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other approved noncombustible materials. Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Type III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.

**3406A.4 Dimensions.** Stairs shall be at least 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm) and landings at the foot of stairs not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than 8 inches (203 mm) below the door.

**3406A.5 Opening protectives.** Doors and windows along the fire escape shall be protected with  $\frac{3}{4}$ -hour opening protectives.

### SECTION 3407A GLASS REPLACEMENT

**3407A.1 Conformance.** The installation or replacement of glass shall be as required for new installations.

### SECTION 3408A CHANGE OF OCCUPANCY

**3408A.1 Conformance.** No change shall be made in the use or occupancy of any building that would place the building in a different division of the same group of occupancies or in a different group of occupancies, unless such building is made to comply with the requirements of this code for such division or group of occupancies. Subject to the approval of the building official, the use or occupancy of existing buildings shall be permitted to be changed and the building is allowed to be occupied for purposes in other groups without conforming to all the requirements of this code for those groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

**3408A.2 Certificate of occupancy.** A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met.

**3408A.3 Stairways.** An existing stairway shall not be required to comply with the requirements of Section 1009 where the existing space and construction does not allow a reduction in pitch or slope.

**3408A.4 Seismic.** When a change of occupancy results in a structure being reclassified to a higher risk category, the structure shall conform to the seismic requirements for a new structure of the higher risk category.

**Exception:** Specific seismic detailing requirements of Section 1613A for a new structure shall not be required to be met where the seismic performance is shown to be equivalent to that of a new structure. A demonstration of equivalence shall consider the regularity, overstrength, redundancy and ductility of the structure.

### SECTION 3409A HISTORIC BUILDINGS

**3409A.1 Historic buildings.** The provisions of this code relating to the construction, repair, alteration, addition, restoration and movement of structures, and change of occupancy shall not be mandatory for historic buildings where such buildings are judged by the building official to not constitute a distinct life safety hazard.

**3409A.2 Flood hazard areas.** Within flood hazard areas established in accordance with Section 1612A.3, where the work proposed constitutes substantial improvement as defined in Section 1612A.2, the building shall be brought into compliance with Section 1612A.

**Exception:** Historic buildings that are:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places;
2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district; or
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

### SECTION 3410A MOVED STRUCTURES

**3410A.1 Conformance.** Structures moved into or within the jurisdiction shall comply with the provisions of this code for new structures.

### SECTION 3411A ADDITIONS, ALTERATIONS, REPAIRS AND SEISMIC RETROFIT TO EXISTING BUILDINGS OR STRUCTURES DESIGNED IN ACCORDANCE WITH PRE-1973 BUILDING CODE

**3411A.1 General.** Provisions of this section shall apply to hospital buildings which were originally designed to pre-1973 building code and not designated as SPC 3 or higher in accordance with Chapter 6 of the California Administrative Code.

**3411A.1.1 Incidental and minor structural alterations, additions or repairs.** Incidental and minor structural additions shall be permitted provided the additions meet this code for new construction using importance factor, *I*, equal to or greater than 1.0. Alterations or repairs to the existing affected lateral load-resisting elements shall meet the requirements of Sections 3404A or 3405A respectively using importance factor, *I*, equal to or greater than 1.0.

**3411A.1.2 Minor structural alteration, additions or repairs.** Minor structural additions shall be permitted provided the additions meet this code for new construction using importance factor, *I*, equal to or greater than 1.0. Alterations, or repair to existing gravity and lateral load-resisting systems shall be made to conform to the requirements of Sections 3404A or 3405A respectively.

**3411A.1.3 Major structural alteration, additions or repairs.** Major structural alterations, additions or repairs shall be in accordance with Section 3403A, 3404A or 3405A respectively.

## SECTION 3412A COMPLIANCE ALTERNATIVES FOR ADDITIONS, ALTERATIONS, REPAIRS AND SEISMIC RETROFIT TO EXISTING STRUCTURES

**3412A.1 Adoption of ASCE 41.** Except for the modifications as set forth in Sections 3412A and 3413A all additions, alterations, repairs and seismic retrofit to existing structures or portions thereof shall be permitted to be designed in accordance with the provisions of ASCE 41. For load combinations which do not include seismic forces, the new building code provisions of this code shall be applicable.

**3412A.1.1 ASCE 41 Section 1.4 – Rehabilitation Objectives.** Target building performance level shall be as follows:

- a. **For general acute care hospitals along with all structures required for their continuous operation or access/egress** – Immediate Occupancy (IO) Structural Performance Level (S-1) as defined in Section 1.5.1.1 at Basic Safety Earthquake 1 (BSE-1) Seismic Hazard Level as defined in Section 1.6.1.2 and Collapse Prevention (CP) Structural performance level (S-5) per Section 1.5.1.5 at Basic Safety Earthquake 2 (BSE-2) Seismic Hazard Level as defined in Section 1.6.1.1. The nonstructural performance level shall satisfy the requirements of this code for new hospital buildings.

**Exceptions:** Buildings satisfying requirements of Sections 3411A or 3412A.2.

- b. **For pre-1973 buildings which will not be used for general acute care services after January 1, 2030** – Basic Safety Objective (BSO) Level as defined in Section 1.4.1. BSO level includes Life Safety Building Performance (3-C) Level as defined in Section 1.5.3.3 at the Basic Safety Earthquake 1 (BSE-1) Seismic Hazard Level as defined in section 1.6.1.2 and Collapse Prevention (CP) building performance level (5-E) per Section 1.5.3.4 at the Basic Safety Earthquake 2 (BSE-2) Seismic Hazard Level as defined in Section 1.6.1.1.

**Exceptions:** Buildings satisfying requirements of Sections 3411A or 3412A.2.

- c. **All others** – Immediate Occupancy (IO) Building Performance Level of (1-B) as defined in Section 1.5.3.2 at Basic Safety Earthquake 1 (BSE-1) Seismic Hazard Level as defined in Section 1.6.1.2 and Collapse Prevention (CP) building performance level (5-E) per Section 1.5.3.4 at Basic Safety Earthquake 2 (BSE-2) Seismic Hazard Level as defined in Section 1.6.1.1.

**3412A.1.2 Material testing required.** Use of material properties based on historical information as default values shall not be permitted.

**3412A.1.3 Analysis procedure.** The selection of a particular analysis procedure from ASCE 41 shall be subject to the approval of the enforcement agent.

**3412A.1.4 Structural design criteria.** Prior to implementation of ASCE 41 Nonlinear Dynamic Procedure, the ground motion, analysis and design methods, material assumptions and acceptance criteria proposed by the engineer shall be reviewed by the enforcement agent.

**3412A.1.5 Structural observation, testing and inspections.** Construction, testing, inspection and structural observation requirements shall be as required for new construction.

**3412A.2 Seismic evaluation and retrofit of general acute care hospitals.** Notwithstanding any other requirements of this code, existing general acute care hospitals shall comply with the seismic evaluation requirements specified in Chapter 6, of the California Administrative Code, when applicable. Seismic retrofit to comply with requirements specified in Chapter 6 of the California Administrative Code shall be permitted to be in accordance with this section. For load combinations that do not include seismic forces, the new building provisions of this code shall be applicable.

**3412A.2.1 SPC 5 and NPC 4/NPC 5.** Structures and nonstructural components and systems satisfying the requirements of this code for new buildings for Risk Category IV shall be considered to satisfy the requirements of SPC 5 and NPC 4. NPC 4 buildings satisfying operational requirements for NPC 5 of Table 11.1, Chapter 6, of the California Administrative Code, shall be placed in nonstructural performance category NPC 5.

New general acute care hospitals and new building(s), larger than 4000 sq ft, required for general acute care services designed to requirements of this code shall be considered to satisfy the requirements of SPC 5 and NPC 5.

**3412A.2.2 SPC 5 using ASCE 41.** Structures satisfying the requirements of immediate occupancy structural performance level (S-1) in accordance with Section 1.5.1.1 of ASCE 41 at BSE-1, Collapse prevention performance level S-5 in accordance with Section 1.5.1.5 of ASCE 41 at BSE-2 and items identified in Chapter 6, Article 10 of the California Administrative Code, satisfying the requirements of Immediate Occupancy Nonstructural performance level (N-B) per Section 1.5.2.2 of ASCE 41 at BSE-1 shall be considered to comply with SPC 5 requirements of Table 2.5.3, Chapter 6, of the California Administrative Code.

**3412A.2.3 SPC 2 using ASCE 41.** Structures satisfying the requirements of life safety structural performance level (S-3) per Section 1.5.1.3 of ASCE 41 at BSE-1 and items identified in Chapter 6, Article 10, of the California Administrative Code satisfying the requirements of life safety nonstructural performance level (N-C) per Section 1.5.2.3 of ASCE 41 at BSE-1, shall be considered to comply with SPC 2 requirements of Table 2.5.3, Chapter 6, of the California Administrative Code.



**3412A.2.4 NPC.** Nonstructural components for immediate occupancy nonstructural performance level (N-B) in Section 1.5.2.2 shall meet the requirements of this code for new buildings. Nonstructural components for operational nonstructural performance level (NPC-5) in Section 1.5.2.1 shall meet performance level N-B and Section 3413A.1.30. Building satisfying the requirements of nonstructural performance level NPC and N-B as described in this section shall be considered to satisfy the requirements of NPC 5 & NPC 4 of Table 11.1, Chapter 6, of the California Administrative Code, respectively.

Immediate occupancy nonstructural performance level (N-B) in Section 1.5.2.2 and life safety nonstructural performance level (N-C) in Section 1.5.2.3 of ASCE 41 at BSE-1 shall be considered equivalent to NPC 3/NPC 2 and NPC 3R requirements respectively of Table 11.1, Chapter 6, of the California Administrative Code. For NPC 3/NPC 3R/NPC 2, only components listed in Table 11.1, Chapter 6, of the California Administrative Code for NPC 3/NPC 3R/NPC 2 need to satisfy the requirements specified above.

**Exceptions:**

- 1) Evaluation procedure in Article 11, Chapter 6, of the California Administrative Code shall be used for seismic evaluation of NPC 2, NPC 3/NPC 3R, NPC 4 and NPC 5, where specific procedure is not outlined in ASCE 41. Administrative and permitting provisions outlined in Article 11, Chapter 6, of the California Administrative Code shall apply.
- 2) Anchorage and bracing of nonstructural components in buildings in seismic performance categories SPC 1 and SPC 2 with a performance level of NPC 3R shall be permitted to comply with the provisions of Section 1630A of the 1995 California Building Code using an importance factor  $I_p = 1.0$ . The capacity of welds, anchors and fasteners shall be determined in accordance with requirements of this code.
- 3) Anchorage and bracing of nonstructural components in buildings in seismic performance categories SPC 1 or SPC 2 with a performance level of NPC 3 or higher, and SPC 3 or SPC 4, shall be permitted to comply with the provisions of Section 1630B of the 1998 California Building Code using an importance factor  $I_p = 1.5$ . The capacity of welds, anchors and fasteners shall be determined in accordance with requirements of this code.

A continuous load path of sufficient strength and stiffness between the component and the supporting structure shall be verified. Local elements of the supporting structure shall be verified for the component loads where they control the design of the elements or their connections. Increases in  $F_p$  due to anchorage conditions (for example shallow anchors) need not be considered. For NPC 3R, the adequacy of load path for nonstructural elements need only be verified when the total reaction at the point of support (including the application of  $F_p$ ) exceeds the following limits:

1. 250 pounds for components or equipment attached to light frame walls. For the purposes of this require-

ment, the sum of the absolute value of all reactions due to component loads on a single stud shall not exceed 250 pounds.

2. 1,000 pounds for components or equipment attached to roofs, or walls of reinforced concrete or masonry construction.
3. 2,000 pounds for components or equipment attached to floors or slabs-on-grade.

**Exception:** If the anchorage or bracing is configured in a manner that results in significant torsion on a supporting structural element, the effects of the nonstructural reaction force on the structural element shall be considered in the anchorage design.

## SECTION 3413A MODIFICATIONS TO ASCE 41

**3413A.1 General.** The text of ASCE 41 shall be modified as indicated in Sections 3413A.1.1 through 3413A.1.32.

**3413A.1.1 ASCE 41 Section 1.1.** Modify ASCE 41 Section 1.1 with the following:

Seismic evaluations shall be performed using procedure and criteria of ASCE 41 except for general acute care hospitals, which shall be evaluated per Chapter 6, of the California Administrative Code. when required per provisions of that chapter.

**3413A.1.2 ASCE 41 Section 1.6 Seismic Hazard.** Modify ASCE 41 Section 1.6 with the following:

Response spectra and acceleration time histories shall be constructed in accordance with Sections 1613A and 1803A.6. Basic Safety Earthquake 2 (BSE-2) in ASCE 41 shall be same as Maximum Considered Earthquake (MCE) in ASCE 7. Basic Safety Earthquake 1 (BSE-1) shall be two-thirds of BSE-2.

**3413A.1.3 ASCE 41 Section 2.2.6.** Modify ASCE 41 Section 2.2.6 with the following:

**Data collection requirements.** The extent of data collection shall be at Comprehensive level for all structures except that data collection at Usual level shall be permitted for structures with BSO or lower target performance objective. Materials properties testing program shall be pre-approved by the enforcement agent.

Tension testing of reinforcing bars shall be in accordance with ASTM A 370 Annex A9. All test specimens shall be the full section of the bar as rolled (8-in. gage length) and shall not be reduced.

Structural members, slabs and walls shall be repaired equivalent to their original condition at test sample locations.

For buildings, built under an OSHPD permit based on the 1976 or later edition of the CBC, where materials properties are shown on design drawings and original materials test data are available, no materials testing shall be required when approved by the enforcement agent.

**3413A.1.4 ASCE 41 Section 2.4.1.1.** Modify ASCE 41 Section 2.4.1.1 with the following:

1. If one or more component DCRs exceed 1.5 for the Immediate Occupancy Structural Performance Level (S-1) or 2.0 for the Life Safety Structural Performance level (S-3) and any irregularity described in Section 2.4.1.1.1 through 2.4.1.1.4 is present, then linear procedures are not applicable and shall not be used.
2. Linear procedures are not applicable to moment resisting frames where plastic hinges do not form in either the beam at the face of column or in the column panel zone.

**3413A.1.5 ASCE 41 Section 2.4.2.1.** Modify ASCE 41 Section 2.4.2.1 with the following:

**Nonlinear static procedure.** If higher mode effects are significant and building is taller than 75 feet above the base, the Nonlinear Dynamic Procedure shall be used.

**3413A.1.6 ASCE 41 Section 2.4.4.5.** Modify ASCE 41 Section 2.4.4.5 by the following:

**Material properties.** Expected material properties are not permitted to be determined by multiplying lower bound values by the assumed factors specified in Chapters 5 through 8.

**3413A.1.7 ASCE 41 Section 3.2.10.1.** Modify ASCE 41 Section 3.2.10.1 with the following:

**Linear procedures.** Equation 3-5 is not permitted by OSHPD.

**3413A.1.8 ASCE 41 Section 3.3.1.3.5.** Replace ASCE 41 Section 3.3.1.3.5 as follows:

**Unreinforced masonry buildings.** Unreinforced Masonry not permitted by OSHPD.

**3413A.1.9 ASCE 41 Section 3.3.3.2.2.** Modify ASCE 41 Section 3.3.3.2.2 with the following:

**Simplified NSP Analysis.** Not permitted by OSHPD.

**3413A.1.10 ASCE 41 Section 3.4.2.2.** Modify ASCE 41 Section 3.4.2.2 with the following:

**Acceptance criteria for linear procedures – drift limitations.** The interstory drift ratio shall not exceed the drift limits for Risk Category IV buildings in ASCE 7 Table 12.12-1 due to forces corresponding to BSE-1, except that buildings designed to BSO or lower performance levels are permitted to meet the drift limits for Risk Category II buildings. For dual systems, the least interstory drift ratio shall control.

**Exception:** Larger interstory drift ratios shall be permitted where justified by rational analysis that both structural and nonstructural elements can tolerate such drift and approved by the enforcement agent.

**3413A.1.11 ASCE 41 Section 3.4.3.2.1.** Modify ASCE 41 Section 3.4.3.2.1 with the following:

**Deformation-controlled actions.** For any building required to meet the Operational Building Performance level, 1-A or Immediate Occupancy Building Performance

Level, 1-B, primary components shall be within the acceptance criteria for primary components and secondary components shall be within the acceptance criteria for secondary components.

**3413A.1.12 ASCE 41 Section 4.4.** Modify ASCE 41 Section 4.4 with the followings:

**Foundation strength and stiffness.** Foundation and soil strength shall be used to evaluate potential overturning, uplift and sliding for fixed base assumptions, and stiffness for flexible base assumptions, including deformations associated with those actions.

**3413A.1.13 ASCE 41 Section 4.4.1.1.** Replace ASCE 41 Section 4.4.1.1 as follows:

**Presumptive capacities.** Not permitted by OSHPD.

**3413A.1.14 ASCE 41 Section 4.4.1.2.** Replace ASCE 41 Section 4.4.1.2 as follows:

**Prescriptive expected capacities.** Not permitted by OSHPD.

**3413A.1.15 ASCE 41 Section 4.4.3.2.2.** Modify ASCE 41 Section 4.4.3.2.2 with the following:

**Flexible base assumption.** The soil strength shall be evaluated.

**3413A.1.16 ASCE 41 Section 4.5.** Modify ASCE 41 Section 4.5 with the following:

**Seismic earth pressure.** Where the grade difference from one side of the building to another exceeds one-half story height, the seismic increment of earth pressure shall be added to the gravity lateral earth pressure to evaluate the building overturning and sliding stability and the lateral force resisting system below grade in combination with the building seismic forces.

**3413A.1.17 ASCE 41 Table 5.6.** Modify ASCE 41 Table 5.6 with the following:

**Acceptance criteria for nonlinear procedures—structural steel components.** For fully and partially restrained moment connections designed to 1989 or prior edition of the California Building Code shall be verified for the presence of welds using E70T-4 electrodes or other electrodes with equivalent aluminum content. Where E70T-4 or equivalent electrodes are present, the plastic rotation angles and residual strength ratios used shall be substantiated by the statistical analysis of three or more applicable cyclic test results subject to the approval of the enforcement agent.

**3413A.1.18 ASCE 41 Section 6.7.1.1.** Modify ASCE 41 Section 6.7.1.1 with the following:

**Monolithic reinforced concrete shear walls and wall segments.** For nonlinear procedures, shear walls or wall segments with axial loads greater than  $0.35 P_o$  shall be included in the model as primary elements with appropriate strength and stiffness degrading properties assigned to those components subject to the approval of the enforcement agent. For linear procedures, the effects of deformation compatibility shall be investigated using moment-curvature section analyses and cyclic testing

results of similar components to determine whether strengthening is necessary to maintain the gravity load carrying capacity of that component.

Horizontal wall segments or spandrels reinforced similar to vertical wall segments or piers shall be classified as wall segments, not shear wall coupling beams, in Tables 6-18 through 6-21.

**3413A.1.19 ASCE 41 Section 7.3.2.** Replace ASCE 41 Section 7.3.2 as follows:

**Unreinforced masonry walls and piers in-plane.** Not permitted by OSHPD.

**3413A.1.20 ASCE 41 Section 7.3.3.** Replace ASCE 41 Section 7.3.3 as follows:

**Unreinforced masonry walls out-of-plane.** Not permitted by OSHPD.

**3413A.1.21 ASCE 41 7.3.4.2.2 Shear strength of walls and piers.** Modify ASCE 41 Section 7.3.4.2.2 with the following:

The spacing of shear reinforcing,  $S$ , shall be less than or equal to the wall pier clear height divided by 2 or the story height divided by 2, whichever is smaller.

**3413A.1.22 ASCE 41 Section 9.2.4.** Modify ASCE 41 Section 9.2.4 with the following:

**Linear procedures.** Verification of the interstory lateral displacements, isolator displacements, the strength adequacy of the seismic force resisting system and isolation system, and anchorage to the foundation shall be accomplished using the nonlinear dynamic procedure.

**3413A.1.23 ASCE 41 Section 9.2.5.1.** Modify ASCE 41 Section 9.2.5.1 with the following:

**Nonlinear static procedure.** Verification of the interstory lateral displacements, isolator displacements, the strength adequacy of the seismic force resisting system and isolation system, and anchorage to the foundation shall be accomplished using the nonlinear dynamic procedure.

**3413A.1.24** Reserved.

**3413A.1.25** Reserved.

**3413A.1.26 ASCE 41 Section 9.3.4.** Modify ASCE 41 Section 9.3.4 with the following:

**Linear Procedures.** Verification of the interstory lateral displacements, damper relative velocities and displacements, the strength adequacy of the seismic force resisting system and damping system, and anchorage to the foundation shall be accomplished using the nonlinear dynamic procedure.

**3413A.1.27 ASCE 41 Section 9.3.5.1.** Modify ASCE 41 Section 9.3.5.1 with the following:

**Nonlinear static procedure.** Verification of the interstory lateral displacements, damper relative velocities and displacements, the strength adequacy of the seismic force resisting system and damping system, and anchorage to the foundation shall be accomplished using the nonlinear dynamic procedure.

**3413A.1.28** Reserved.

**3413A.1.29 ASCE 41 Chapter 10.** Replace ASCE 41 Chapter 10 as follows:

**Simplified rehabilitation.** Not permitted by OSHPD.

**3413A.1.30 ASCE 41 Section 11.3.2.** Modify ASCE 41 Section 11.3.2 with the following:

**Operational nonstructural performance level (NPC-5) requirements.** All Structures shall meet immediate occupancy nonstructural performance level (N-B) and facility shall have on-site supplies of water and holding tanks for sewage and liquid waste, sufficient to support 72 hours emergency operations, are integrated into the building plumbing systems in accordance with the California Plumbing Code. An on-site emergency system as defined in the California Electrical Code is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.

**3413A.1.31 ASCE 41 Section 11.9.4.3.1.** Modify ASCE 41 Section 11.9.4.3.1 with the following:

Ceilings in all categories shall satisfy requirements for ceilings in Category C specified in this section.

**3413A.1.32 ASCE 41 Section 11.10.2.4.** Modify ASCE 41 Section 11.10.2.4 by the following:

For general acute care hospital, nonstructural evaluation shall comply with requirements of Section 11.2, Chapter of the California Administrative Code.

## SECTION 3414A PEER REVIEW REQUIREMENTS

**3414A.1 General.** Independent peer review is an objective technical review by knowledgeable reviewer(s) experienced in structural design, analysis and performance issues involved. The reviewer(s) shall examine the available information on the condition of building, basic engineering concept employed and recommendations for action.

**3414A.2 Timing of independent review.** The independent reviewer (s) shall be selected prior to initiation of substantial portion of the design and analysis work that is to be reviewed, and review shall start as soon as practical and sufficient information defining the project is available.

**3414A.3 Qualifications and terms of employment.** The reviewer shall be independent from the design and construction team.

**3414A.3.1** The reviewer(s) shall have no other involvement in the project before, during or after the review, except in a review capacity.

**3414A.3.2** The reviewer shall be selected and paid by owner and shall have technical expertise in repair of buildings similar to the one being reviewed, as determined by enforcement agent.

**3414A.3.3** The reviewer (in case of review team, the chair) shall be a California-licensed structural engineer who is



familiar with technical issues and regulations governing the work to be reviewed.

**3414A.3.4** *The reviewer shall serve through completion of the project and shall not be terminated except for failure to perform the duties specified herein. Such termination shall be in writing with copies to enforcement agent, owner, and the engineer of record. When a reviewer is terminated or resigns, a qualified replacement shall be appointed within 10 working days.*

**3414A.4 Scope of review.** *Review activities shall include, where appropriate, available construction documents, design criteria, observation of the condition of structure, all new and original inspection reports, including methods of sampling, analyses prepared by the engineer of record and consultants, and the retrofit or repair design. Review shall include consideration of the proposed design approach, method, materials and details.*

**3414A.5 Reports.** *The reviewer(s) shall prepare a written report to the owner and responsible enforcement agent that covers all aspect of the review performed including conclusions reached by the reviewer. Report shall be issued after the schematic phase, during design development, and at the completion of construction documents, but prior to their issuance of permit. Such report shall include, at the minimum, statement of the following.*

1. *Scope of engineering design peer review with limitations defined.*
2. *The status of the project documents at each review stage.*
3. *Ability of selected materials and framing systems to meet the performance criteria with given loads and configuration.*
4. *Degree of structural system redundancy and the deformation compatibility among structural and nonstructural elements.*
5. *Basic constructability of the retrofit or repair system.*
6. *Other recommendation that will be appropriate for the specific project.*
7. *Presentation of the conclusions of the reviewer identifying any areas that need further review, investigation and/or clarification.*
8. *Recommendations.*

**3414A.6 Responses and corrective actions.** *The engineer of record shall review the report from the reviewer(s) and shall develop corrective actions and other responses as appropriate. Changes observed during construction that affect the seismic-resisting system shall be reported to the reviewer in writing for review and recommendations. All reports, responses and corrective actions prepared pursuant to this section shall be submitted to the responsible enforcement agent and the owner along with other plans, specifications and calculations required. If the reviewer resigns or is terminated by the owner prior to completion of the project, then the reviewer shall sub-*

*mit copies of all reports, notes, and the correspondence to the responsible enforcement agent, the owner, and the engineer of record within 10 working days of such termination.*

## **SECTION 3415A EARTHQUAKE MONITORING INSTRUMENTS FOR EXISTING BUILDINGS**

**3415A.1 Earthquake recording instrumentation of existing buildings.** *All owners of existing structures, selected by the enforcement agency for the installation of earthquake-recording instruments, shall provide space for the installation and access to such instruments. Location of said instruments shall be determined by the enforcement agency. The enforcement agency shall make arrangements to provide, maintain, and service the instruments. Data shall be the property of the enforcement agency, but copies of individual records shall be made available to the public on request and the payment of an appropriate fee.*

## **SECTION 3416A COMPLIANCE ALTERNATIVES FOR SERVICES/SYSTEMS AND UTILITIES**

**3416A.1 General.** *The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings while permitting repair, alteration, addition and change of occupancy without requiring full compliance with Chapters 2 through 33, or Sections 3401A.3, and 3403A through 3408A, except where compliance with other provisions of this code is specifically required in this section.*

*Services/systems and utilities that originate in and pass through or under buildings and are necessary to the operation of an acute care hospital, skilled nursing facility, intermediate care facility or correctional treatment center shall meet the structural requirements of this section. Examples of services/systems and utilities include but are not limited to normal power; emergency power; nurse call; fire alarm; communication and data systems; space-heating systems; process load systems; cooling systems; domestic hot and cold water systems; means of egress systems; fire-suppression systems; building drain and sewer systems; and medical gas systems that support basic and supplemental services.*

*After January 1, 2030, services/systems and utilities for acute care hospital buildings shall not originate in or pass through or under a nonhospital or Hospital building unless it has approved performance categories of SPC-3 or higher and NPC-5.*

**3416A.1.1 Services/systems and utilities.** *Services/systems and utilities that are necessary to the operation of an acute care hospital, skilled nursing facility, intermediate care facility, or correctional treatment center shall meet the structural requirements of this section, based upon the approved Structural Performance Category (SPC) of the building receiving the services/systems and utilities.*

Services from an acute care hospital, skilled nursing facility or a correctional treatment center shall be permitted to serve a nonconforming building with prior approval of the Office. The services/systems and utilities in the nonconforming building shall be equipped with fail safe valves, switches or other equivalent devices that allow the nonconforming building to be isolated from the acute care hospital buildings.

**Exception:** Remodel projects that use available existing services/systems and utilities are exempted from the requirements of this section. The enforcing agency shall be permitted to exempt minor addition, minor alteration, and minor remodel projects and projects to upgrade existing services/systems and utilities from the requirements of this section.

#### **3416A.1.1.1 Services/systems and utilities for hospital buildings.**

**3416A.1.1.1.1 New buildings, additions, alterations, and remodels of conforming (SPC-3, -4, or -5) hospital buildings.** Services/systems and utilities for new buildings and additions, and alterations or remodels to existing conforming buildings shall originate in hospital buildings that have approved performance categories of SPC-3 or higher and NPC-4 or higher. The services/systems and utilities shall not pass through or under buildings that do not have approved performance categories of SPC-2 or higher and NPC-4 or higher.

**Exception:** Services/systems and utilities shall be permitted to pass through or under buildings that have approved nonstructural performance categories of NPC-3 or higher or NPC-2, provided that the building has an approved extension to the NPC-3 deadline. The services/systems and utilities feeding the new building addition, alteration, or remodel shall conform to the new building provisions of this code and shall be deemed by OSHPD to be free of adverse seismic interactions caused by potential failure of overhead or adjacent components.

**3416A.1.1.1.2 Additions, alterations, and remodels of SPC-2 hospital buildings.** Services/systems and utilities for additions, alterations, or remodels of SPC-2 hospital buildings shall be permitted to originate in and pass through or under SPC-2 or higher buildings that have an approved nonstructural performance category of NPC-3 or higher.

**Exception:** Services/systems and utilities shall be permitted to may pass through or under buildings that have approved nonstructural performance categories of NPC-2, provided that the building has an approved extension to the NPC-3 deadline. Services/systems and utilities feeding the addition, alteration or remodel shall conform to the nonstructural bracing requirements for new buildings.

**3416A.1.1.1.3 Alterations and remodels of SPC-1 hospital buildings.** Services/systems and utilities for alterations or remodels of SPC-1 hospital buildings shall be permitted to originate in and pass through or under SPC-1 or higher buildings that have an approved nonstructural performance category of NPC-2 or higher.

#### **3416A.1.1.1.4 Buildings without SPC/NPC ratings.**

When services/systems and utilities for new buildings, additions, alterations, or remodels pass through or under hospital buildings which would not otherwise require evaluation for an SPC rating, such buildings shall be evaluated in accordance with the requirements of Section 1.3, Chapter 6, Part 1, California Administrative Code, to determine the appropriate ratings, or shall be shown to meet the structural requirements of these regulations for new hospital buildings. The services/systems and utilities feeding the new building addition, alteration, or remodel shall conform with new building provisions of this code and shall be deemed by OSHPD to be free of adverse seismic interactions caused by potential failure of overhead or adjacent components.

**3416A.1.1.1.5 Buildings removed from acute-care hospital service.** Services/systems and utilities for conforming acute care hospital buildings shall be permitted to pass through or under a building that has been removed from acute care hospital service until January 1, 2030 if the building removed from service meets the performance requirements of Section 3416A.1.1.1.1. Services/systems and utilities for nonconforming acute care hospital buildings shall be permitted to pass through or under a building that has been removed from acute care hospital service only if the building removed from service and meets the performance requirements of Section 3416A.1.1.1.2.

#### **3416A.1.1.2 Services/systems and utilities for skilled nursing facilities, intermediate care facilities, and correctional treatment centers.**

**3416A.1.1.2.1 New buildings and additions.** Services/systems and utilities for new buildings and additions shall not originate in or pass through or under nonconforming structures.

**Exception:** As an alternate to this section, skilled nursing and intermediate care facilities, and correctional treatment centers shall be permitted to meet the requirements in Section 3416A.1.1.1 for hospital buildings.

**3416A.1.1.2.2 Alterations and remodels.** Services/systems and utilities for alterations or remodels of existing buildings shall be permitted to pass through nonconforming structures, provided the new services/systems and utilities passing through the buildings are anchored and braced for seismic forces in accordance with these regulations for new buildings and are free of adverse seismic interactions caused by potential failure of overhead or adjacent components.



**3416A.1.2 Jurisdiction.** Services/systems and utilities for hospitals, skilled nursing facilities and intermediate-care facilities shall originate in and only pass through or under buildings that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

## SECTION 3417A COMPLIANCE ALTERNATIVES FOR MEANS OF EGRESS

**3417A.1 General.** Means of egress through existing buildings shall be in accordance with Chapter 10 except as modified in this section.

**3417A.1.1 Means of egress for hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.** Means of egress for acute care hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers shall comply with the requirements of Sections 3417A.1.1.1 and 3417A.1.1.2.

**Exception:** The enforcing agency shall be permitted to exempt minor additions, minor alterations and minor remodel projects from these requirements.

**3417A.1.1.1 Means of egress for hospital buildings.** Means of egress for hospital buildings shall comply with the requirements of Sections 3417A.1.1.1.1 through 3417A.1.1.1.6.

**3417A.1.1.1.1 New and existing conforming hospital buildings.** Means of egress for new hospital buildings and additions to existing conforming hospital buildings shall only pass through buildings that comply with the requirements of SPC-3 or higher and NPC-4 or higher.

**Exception:** Existing means of egress that pass through hospital buildings that have approved nonstructural performance categories NPC-3, or NPC-2, if the building has an approved extension to the NPC-3 deadline, shall be permitted to remain for the duration of extension. The nonstructural components in the path of egress shall be braced in accordance with the new building provisions of this code.

**3417A.1.1.1.2 Existing SPC-2 hospital buildings.** Means of egress for additions to existing SPC-2 hospital buildings shall only pass through hospital buildings that have OSHPD-approved performance categories of SPC-2 or higher and NPC-4 or higher.

**Exception:** The means of egress shall be permitted to pass through hospital buildings that have approved nonstructural performance categories of NPC-3, or NPC-2 if the building has an approved extension to the NPC-3 deadline. Nonstructural components in the path of egress shall be braced in accordance with the new building provisions of this code.

**3417A.1.1.1.3 Existing SPC-3 or higher hospital buildings.** Means of egress for remodels of existing SPC-3 or higher hospital buildings shall only pass through hospital buildings that have approved perfor-

mance categories of SPC-2 or higher and NPC-4 or higher.

**Exception:** The means of egress shall be permitted to pass through hospital buildings that have approved nonstructural performance categories of NPC-3, or NPC-2 if the building has an approved extension to the NPC-3 deadline. Nonstructural components in the path of egress shall be braced in accordance with the new building provisions of this code.

**3417A.1.1.1.4 Existing SPC-1 hospital buildings.** Means of egress for remodels of existing SPC-1 hospital buildings shall only pass through hospital buildings that have approved performance categories of SPC-1 or higher and NPC-2 or higher.

**Exception:** Means of egress for acute care service spaces for hospitals licensed pursuant to subdivision (a) of Section 1250 of the Health and Safety Code shall comply with the requirements of Section 3417A.1.1.1.2.

**3417A.1.1.1.5 Other nonconforming hospital buildings.** Hospital buildings that would not otherwise require evaluation for an SPC rating, which are used as a part of the means of egress for acute care hospitals, shall be evaluated in accordance with the requirements of Section 1.3, Chapter 6, of the California Administrative Code to determine the appropriate rating, or shall meet the structural requirements of these regulations for conforming hospital buildings. Means of egress shall be in accordance with the requirements of Sections 3417A.1.1.1.1 through 3417A.1.1.1.4.

**3417A.1.1.1.6 Buildings removed from hospital service.** The means of egress for acute care hospitals shall be permitted to pass through buildings that are removed from hospital service only if the buildings remain under the jurisdiction of OSHPD, and only until January 1, 2030, subject to the following:

1. Egress for conforming hospital buildings shall be permitted to pass through buildings that have been removed from acute care hospital service that comply with the requirements of Section 3417A.1.1.1.1 or 3417A.1.1.1.3.
2. Egress for nonconforming hospital buildings shall be permitted to pass through buildings that have been removed from acute care hospital service that comply with the requirements of Section 3417A.1.1.1.2 or 3417A.1.1.1.4.

After January 1, 2030, the means of egress for acute care hospital buildings shall only pass through hospital buildings that have approved performance categories of SPC-3 or higher and NPC-5.

**3417A.1.1.2 Means of egress for skilled nursing facilities, intermediate care facilities and correctional treatment centers.** Means of egress for skilled nursing facilities, intermediate-care facilities and correctional treatment centers shall comply with the requirements of Sections 3417.1.1.2.1 and 3417.1.1.2.2.

**3417A.1.1.2.1 New facilities or additions to existing facilities.** Means of egress for new or additions to skilled nursing facilities, intermediate care facilities, or correctional treatment centers shall only pass through conforming buildings.

**Exception:** As an alternate, skilled nursing facilities, intermediate care facilities and correctional treatment centers shall be permitted to meet the egress requirements in Sections 3417A.1.1.1.1 through 3417A.1.1.1.5 for hospital buildings.

**3417A.1.2 Jurisdiction.** Means of egress for hospitals, skilled nursing facilities and intermediate-care facilities shall only pass through buildings that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

## SECTION 3418A REMOVAL OF HOSPITAL BUILDINGS FROM GENERAL ACUTE CARE SERVICES

**3418A.1 General.** The requirements of this section shall apply when general acute care services are completely removed from SPC buildings or when buildings are removed from OSHPD jurisdiction. All buildings that remain under the OSHPD jurisdiction, after one or more SPC buildings are removed, shall satisfy the requirements of the California Building Standards Code. Approval of construction documents and a building permit are required for removal of SPC Buildings from general acute care services or removal of buildings from OSHPD jurisdiction.

**3418A.2 Definitions.** The following words and terms are applicable to this section only:

**BUILDING.** The area included within surrounding exterior walls or any combination of exterior walls and fire walls (as described in Sections 202 and 706) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above. A building may consist of one or more adjacent SPC buildings.

**GENERAL ACUTE CARE SERVICE.** Means basic and supplemental services, as defined in Section 1224.3, provided in a general acute care hospital building, as defined in Section 1224.3 and the California Administrative Code, Chapter 6, Section 1.2.

**SPC BUILDING.** Means a structure with an independent vertical and lateral force resisting system (LFRS) and a distinct building structural performance category assigned by OSHPD.

**SPC SEISMIC SEPARATION.** Means a building separation in accordance with the California Administrative Code, Chapter 6 Section 3.4.

**STRUCTURAL SEPARATION.** Means a building separation in accordance with this code.

**3418A.3 Establishing eligibility for removal from general acute care service.** In order to establish that one or more SPC

buildings are eligible for removal from general acute care service, the hospital owner shall submit construction documents showing that after the SPC Buildings are removed from general acute care service:

1. All basic acute care services or supplemental services on the hospital's license are provided in SPC buildings satisfying the requirements for SPC-2, SPC-3, SPC-4 or SPC-5.

**Exception:** If the hospital includes SPC-1 buildings that are not being removed from general acute care service, and these SPC-1 buildings have an approved extension to the SPC-2 deadline, basic acute care services or supplemental services on the hospital's license are permitted to remain in these SPC buildings for the duration of their extension or until these SPC-1 buildings are removed from general acute care service, whichever comes first.

2. All basic acute care services or supplemental services on the hospital's license are provided in SPC buildings satisfying the requirements for NPC-3, NPC-4 or NPC-5.

**Exception:** Services shall be permitted to be located in SPC buildings satisfying the requirements of NPC-2 if the SPC buildings has approved extension to NPC-3 deadline.

3. The hospital complies with all egress requirements, including occupant load, number of required exits and travel distance to exits, and provides evidence that no egress from any acute care hospital building passes through the SPC buildings removed from general acute care service, SPC-1 buildings, or through buildings not under OSHPD jurisdiction.

### Exceptions:

1. If the SPC building has an approved extension to the SPC-2 deadline, existing egress through the SPC-1 building shall be permitted for the duration of the extension or until the SPC-1 building is removed from general acute care service, whichever comes first.
2. When permitted by Section 3417A.1.1.1.6.
4. No SPC building removed from general acute care service is used as a smoke compartment for any acute care hospital building. Buildings not under OSHPD jurisdiction shall not be used as a smoke compartment for any acute care hospital building.
5. Structural separation, fire barriers and fire walls shall satisfy the requirements of the California Building Standards Code.

**Exception:** An SPC seismic separation in accordance with the California Administrative Code Chapter 6 Section 3.4 shall be deemed to satisfy the building structural/seismic separation requirement in this section for SPC buildings that will remain under OSHPD jurisdiction.

6. If the SPC building removed from general acute care service shares a common fire alarm system with the

acute care hospital, the main fire alarm control panel shall be located in an acute care hospital building. The SPC building removed from general acute care service shall be in a separate zone monitored by the main fire alarm control panel. Flexible connections shall be provided for conduits/conductors crossing structural or SPC seismic separation joints. If the intent is to place the SPC building under local jurisdiction, the building shall satisfy Section 3418A.5.1

7. If the SPC building removed from general acute care service shares the fire sprinkler system with the acute care hospital, an isolation valve with a tamper switch shall be provided to isolate the portion of the system serving the SPC building removed from acute care service. Flexible connections shall be provided in piping that crosses structural or SPC seismic separation joints. The fire sprinkler system shall not originate in the SPC building removed from general acute care service. If the intent is to place the building under local jurisdiction, the building shall satisfy Section 3418A.5.1.
8. Patient access as required by Section 1224.4.7.5 does not pass through an SPC building removed from general acute care service or through buildings that are not under the jurisdiction of OSHPD.
9. The primary accessible entrance to the hospital is not through an SPC building removed from general acute care service or through buildings that are not under the jurisdiction of OSHPD.
10. No utilities servicing acute care hospital buildings originate in or pass through, over or under, an SPC building removed from general acute care service, except as permitted by Section 3416A.1.1.1.5, or a building not under OSHPD jurisdiction.
11. If utilities originating in an acute care hospital building feed an SPC building removed from general acute care hospital service, fail safe shut-off valves and/or disconnects shall be provided that permit isolation of the SPC building removed from general acute care service from the hospital utilities. Flexible connections shall be provided for all utilities crossing structural or SPC seismic separation joints.

#### **3418A.4 Buildings intended to remain under OSHPD jurisdiction.**

**3418A.4.1 Qualifying nonacute care services.** In order for a building to remain under OSHPD jurisdiction that is removed from general acute care service, it shall contain one or more qualifying services. Qualifying services include:

- a. Services considered "Outpatient Clinical Services" as defined in H&S § 129730 (a)
  - i. Administrative space
  - ii. Central sterile supply
  - iii. Storage
  - iv. Morgue and autopsy facilities

- v. Employee dressing rooms and lockers
- vi. Janitorial and housekeeping facilities
- vii. Laundry

- b. Outpatient portions of the following services (with no more than 25 percent in-patient use), including but not limited to:
  - i. Surgical
  - ii. Chronic dialysis
  - iii. Psychiatry
  - iv. Rehabilitation, occupational therapy or physical therapy
  - v. Maternity
  - vi. Dentistry
  - vii. Chemical dependency
- c. Services that duplicate Basic Services, as defined in H&S §1250, or services that are provided as part of a Basic Service, but are not required for facility licensure (with no more than 25 percent in-patient use).

All hospital support services listed in Section 3418A.4.1 Item a that are located in an SPC building at the time general acute care services are removed may remain, provided the California Department of Public Health certifies to the Office that it has received and approved a plan that demonstrates how the health facility will continue to provide all basic services in the event of any emergency when the SPC building may no longer remain functional. This certification shall be submitted by hospital to the Office prior to approval of the application to remove the SPC building from general acute care service.

**3418A.4.2 Maintaining existing nonacute care services under existing license.** Existing approved nonacute care occupancies, or services, existing in the SPC building at the time it is removed from general acute care service shall be permitted to remain, and removal of the SPC building from general acute care service is not considered a change in occupancy. The enforcement agency shall be permitted to require evidence that the existing occupancies and services were in compliance at the time they were located in the SPC building. Any hospital support services located in the building removed from general acute care service, including administrative services, central sterile supply, storage, morgue and autopsy, employee dressing rooms and lockers, janitorial and housekeeping service, and laundry, shall be in excess of the minimum requirements for licensure and operation. Prior approval by the California Department of Public Health shall be obtained by hospital to maintain these services in the SPC building removed from acute care service.

**3418A.4.3 Change of licensed services under existing license.** A change of service or function for all, or a portion, of the SPC building removed from general acute care service requires compliance with the current requirements for that service, including accessibility requirements in accordance with Chapter 11B.



**3418A.4.3.1 Skilled nursing or acute psychiatric services.** When general acute care services are removed from an SPC building which is intended to be used for skilled nursing or acute psychiatric services, and the new services will be licensed under the existing license of the general acute care hospital these new services shall comply with Section 3416A.1.1.1.5 for a nonconforming hospital building.

**3418A.4.3.2 Outpatient clinical services.** When general acute care services are removed from an SPC building that is intended to be used for outpatient clinical services under the existing acute care hospital license, the building is required to comply with the current OSHPD 3 code requirements for the new service.

**3418A.4.4 SPC buildings removed from general acute care service with new license.** When general acute care services are removed from an SPC building, and new services provided in the SPC building are issued an initial license, as determined by the California Department of Public Health, as a skilled nursing facility or acute psychiatric hospital, the SPC building shall comply with the new building code requirements or equivalent provisions of the California Building Standards code at the time of application.

**3418A.4.5 Change of building occupancy or division.** When an SPC building is removed from general acute care service with or without change of license, the new occupancy group and division of the building, and/or new service or function, shall be established. A new certificate of occupancy shall be required for the building removed from general acute care service.

**3418A.5 Change in jurisdiction for buildings removed from general acute care service.** Except as provided by Section 3418A.5.3, at the hospital's discretion, a building removed from general acute care service shall be permitted to be placed under the jurisdiction of the local enforcement agency. To be eligible for a change in jurisdiction, the building removed from general acute care service shall satisfy the requirements of Section 3418A.5.1.

**3418A.5.1 Eligibility for change in jurisdiction.** For a building removed from general acute care service to be eligible for a change in jurisdiction to the local enforcing agency, all the following criteria shall be satisfied:

- a. The building removed from general acute care service shall be freestanding, as defined in the California Administrative Code, Section 7-111.
- b. Any hospital support services located in the building removed from general acute care service, including administrative services, central sterile supply, storage, morgue and autopsy, employee dressing rooms and lockers, janitorial and house-keeping service, and laundry, shall be in excess of the minimum requirements for licensure and operation. Prior approval by the California Department of Public Health shall be obtained by hospital to locate these services in the building removed from general acute care service.

- c. Services/systems and utilities (e.g., power, emergency power, communication/data/nurse-call systems, space-heating systems, fire alarm system, fire-sprinkler system, medical gas and plumbing systems) shall be separate and independent from those serving any buildings under OSHPD jurisdiction.
- d. If the building being transferred to the jurisdiction of the local enforcing agency is adjacent to a building under OSHPD jurisdiction and fire resistant construction separations are required, they shall be located in the building under OSHPD jurisdiction.

**3418A.5.2 Modification of buildings removed from OSHPD jurisdiction.** The owner of the building shall be responsible for bringing the building into compliance with all requirements of the new authority having jurisdiction. If a building requires modification to become eligible for removal from OSHPD jurisdiction, the construction project shall be closed with compliance by OSHPD prior to the change in jurisdiction. All occupancy separation, set-back, and allowable area requirements shall be enforced.

**3418A.5.3 Buildings not eligible for change in jurisdiction.** The following freestanding buildings shall remain under OSHPD jurisdiction:

- a. Any building in which basic and/or supplementary services are provided for a general acute care hospital, acute psychiatric hospital and general acute care hospital providing only acute medical rehabilitation center services.
- b. Any building that provides required patient access, egress, or smoke compartment for a building under OSHPD's jurisdiction.
- c. Any building in which services under OSHPD jurisdiction are provided, including skilled nursing services, intermediate care services, acute psychiatric services, and distinct part skilled nursing or intermediate care services.
- d. Any building providing central plant or utility services to a building under OSHPD jurisdiction.
- e. Any building through which utilities pass through, over or under, to serve a building under OSHPD jurisdiction.

**3418A.6 Vacant space.** With the removal of general acute care services, the vacated space must be reclassified with an intended occupancy as required under Section 302. If the hospital determines that the building or space in the spc building removed from general acute care service will be vacant, the hospital shall demonstrate that unsafe conditions as described in Section 116.1 are not created.

**3418A.7 Demolition.** Demolition of SPC buildings to be removed from general acute care services shall be permitted when buildings remaining under OSHPD's jurisdiction, after demolition, satisfy the requirements of the California Building Standards Code and demolition activity does not impair the operation and/or safety of any buildings that remain under OSHPD's jurisdiction.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 35 – REFERENCED STANDARDS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.  
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DPH	AGR	DWR	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4							
Adopt entire chapter	X								X	X	X	X							
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X											
Adopt only those sections that are listed below						X													
Chapter/Section																			
AAMA 501.4-09							X	X											
AAMA 501.6-09							X	X											
ACI							X	X											
AF & PA							X	X											
AISC							X	X											
ASI							X	X											
AITC							X	X											
ANSI						X													
ANSI-S3.4.1						X													
ANSI/SDI-C-2012							X	X											
ASCE/SEI							X	X											
ASME						X													
ASME A17.1/CSA B44-07		X				X													
ASME A17.1A/CSA B44A-08						X													
ASME A18.1-2008						X													
ASME BPE-2009		X																	
ASTM							X	X											
ASTM C 114-10							X	X											
ASTM C 1157/C 1157M-11							X	X											
ASTM C 1240-11							X	X											
ASTM C 1249-06a (2011)							X	X											
ASTM C 1260-07							X	X											
ASTM C 1293-08b							X	X											
ASTM C 1392-00 (2009)							X	X											
ASTM C 1394-03 (2008)							X	X											
ASTM C 1401-09a							X	X											
ASTM D 1586-11							X	X											
ASTM D 3441-05							X	X											
ASTM D 3966-07							X	X											
ASTM E 648-04		X																	
ASTM E 662-09		X																	
AWPA							X	X											
AWS							X	X											
BHMA						X													
BHMA A156.10-2011						X													
BHMA A156.19-2007						X													
CPSC																			
FEMA 352-00							X	X											
FM 1950-10							X	X											
FM 3260-00		X																	

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X								X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X												
Adopt only those sections that are listed below						X														
Chapter / Section																				
FM3011-99		X																		
FM4430-80		X																		
ICC							X	X												
ICC ES AC 331		X																		
ICC ES AC 77		X																		
ISO 9001-08							X	X												
ISO 17025-05							X	X												
NFPA						X	X	X												
NFPA 11-13		X																		
NFPA 13-13		X																		
NFPA 13D-13		X																		
NFPA 13R-13		X																		
NFPA 14-13		X																		
NFPA 15-12		X																		
NFPA 17-13		X																		
NFPA 17A-13		X																		
NFPA 20-13		X																		
NFPA 22-13		X																		
NFPA 24-13		X																		
NFPA 31-11		X																		
NFPA 37-10																				
NFPA 52-13		X																		
NFPA 54-12		X																		
NFPA 61-13		X																		
NFPA 72-13		X				X														
NFPA 92a-12		X																		
NFPA 211-13		X																		
NFPA 259-13		X																		
NFPA 275-13		X																		
NFPA 285-13		X																		
NFPA 288-13		X																		
NFPA 289-13		X																		
NFPA 409-13		X																		
NFPA 654-13		X																		
NFPA 703-13		X																		
NFPA 720-12			X	X	X															
NFPA 1124-13		X																		
NFPA 2001-12		X																		
PCI							X	X												
PTI							X	X												
SFM 12-3		X																		
SFM 12-7-3		X																		
SFM 12-7A-1		X																		

(continued)

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter	X								X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)		X	X	X	X		X	X												
Adopt only those sections that are listed below						X														
Chapter / Section		X																		
SFM 12-7A-2		X																		
SFM 12-7A-3		X																		
SFM 12-7A-4		X																		
SFM 12-7A-4A		X																		
SFM 12-7A-5		X																		
SFM 12-8-100		X																		
SFM 12-10-1		X																		
SFM 12-10-2		X																		
SFM 12-10-3		X																		
TMS							X	X												
UBC 15-2		X																		
UBC 15-3		X																		
UBC 15-4		X																		
UL 13-96		X																		
UL 38-99		X																		
UL 193-04		X																		
UL 199-95		X																		
UL 217-06		X																		
UL 228-97		X																		
UL 260-04		X																		
UL 262-04		X																		
UL 268A-98		X																		
UL 312-04		X																		
UL 346-05		X																		
UL 464-03		X																		
UL 497B-04		X																		
UL 521-99		X																		
UL 539-00		X																		
UL 632-00		X																		
UL 753-04		X																		
UL 813-96		X																		
UL 864-03		X																		
UL 2034			X	X	X															
UL 2075			X	X	X															

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*





## CHAPTER 35

# REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in *Chapter 1, Scope and Administration, Division 1, Sections 1.1.5 and 1.1.7, and in Chapter 1, Scope and Administration, Division II, Section 102.4.*

**[DSA-SS, DSA-SS-CC & OSHPD 1 & 4] Reference to other chapters.** *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A, 22A and 34A.*

<div>AA</div> <div>Aluminum Association 1525 Wilson Boulevard, Suite 600 Arlington, VA 22209</div>		
Standard reference number	Title	Referenced in code section number
ADM1—05	Aluminum Design Manual: Part 1-A Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B—Aluminum Structures, Load and Resistance Factor Design . . . . .	1604.3.5, 2002.1
ASM 35—00	Aluminum Sheet Metal Work in Building Construction (Fourth Edition) . . . . .	2002.1

<div>AAMA</div> <div>American Architectural Manufacturers Association 1827 Waldon Office Square, Suite 550 Schaumburg, IL 60173</div>		
Standard reference number	Title	Referenced in code section number
1402—86	Standard Specifications for Aluminum Siding, Soffit and Fascia . . . . .	1404.5.1
AAMA/WDMA/CSA 101/I.S.2/A440—08	North American Fenestration Standard/Specifications for Windows, Doors and Skylights . . . . .	1715.5.1, 2405.5
501.4-09	<i>Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts</i> . . . . .	2410.1
501.6-09	<i>Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall</i> . . . . .	2410.1

<div>ACI</div> <div>American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331</div>		
Standard reference number	Title	Referenced in code section number
216.1—07	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies . . . . .	Table 720.1(2), 721.1
318—11	Building Code Requirements for Structural Concrete . . . . .	1604.3.2, 1614.3.1, 1614.4.1, 1704.3.1.3, Table 1704.3, 1704.4.1, Table 1704.4, Table 1705A.2.1, 1705A.2.2.1.2, 1708. 2, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810A.3.10.4, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.11.1, 1901.2, 1901.3, 1901.4, 1902.1, 1903A, 1903.1, 1904.1, 1904.2, 1904.3, 1904.4.1, 1904.4.2, 1904.5, 1905A, 1905.1.1, 1905.2, 1905.3, 1905.4, 1905.5, 1905.6.2, 1905.6.3, 1905.6.4, 1905.6.5, 1905.7, 1905.8, 1905.9, 1905.10, 1905.11, 1905.12, 1905.13, 1906.1, 1906.2, 1906.3, 1906.4, 1907.1, 1907.2, 1907.3, 1907.4, 1907.5, 1907.6, 1907.7.1, 1907.7.2, 1907.7.3, 1907.7.4, 1907.7.5, 1907.7.6, 1907.8, 1907.9, 1907.10, 1907.11, 1907.12, 1907.13, 1908.1, 1908.1.1, 1908.1.2, 1908.1.3, 1908.1.4, 1908.1.5, 1908.1.6, 1908.1.7, 1908.1.8, 1908.1.9, 1908.1.10, 1909.1, 1909.3, 1909.4, 1909.5, 1909.6, 1912.1, 1913A.5, 1913A.7.2, 1913.2, 1913.3, 2108.3, 2205.3
355.2-07	<i>Qualification of Post-Installed Mechanical Anchors in Concrete &amp; Commentary</i> . . . . .	1616A.1.19
440.2R-08	<i>Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures</i> . . .	1914A.3
503.7—07	<i>Specification for Crack Repair by Epoxy Injection</i> . . . . .	1914A.2

## REFERENCED STANDARDS

### ACI—continued

506—05	<i>Guide to Shotcrete</i> . . . . .	1913.4.5, 1910A.1, 1910A.3, 1910A.12, 1914A.2
530—11	Building Code Requirements for Masonry Structures . . . . .	1405.5, 1405.5.2, 1405.9, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1704.5.3, 1807.1.6.3.2, 1808.9, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2109.2.1, 2109.3, 2110.1, 2114.10, 2114.11
530.1—08	Specifications for Masonry Structures . . . . .	1405.5.1, Table 1704.5.1, Table 1704.5.3, 1807.1.6.3, 2103.8, 2103.11, 2103.12, 2103.13, 2104.1, 2104.1.1, 2104.1.2, 2104.1.3, 2104.2, 2104.3, 2104.4, 2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3

## AF&PA

American Forest & Paper Association  
1111 19th St, NW Suite 800  
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
WCD No. 4—89	Wood Construction Data—Plank and Beam Framing for Residential Buildings . . . . .	2306.1.2
WFCM—01	Wood Frame Construction Manual for One- and Two-family Dwellings . . . . .	1609.1.1, 1609.1.1.1, 2301.2, 2308.1, 2308.2.1
NDS—2012	National Design Specification (NDS) for Wood Construction with 2012 Supplement and addendum. . . . .	1905A.1.2.1, 721.6.3.2, 1716.1.1, 1716.1.4, 1809.12, 1810.3.2.4, Table 1810.3.2.6, 2302.1, 2304.12, 2306.1, Table 2306.2.1(1), Table 2306.2.1(2), Table 2306.3, Table 2306.6, 2307.1, 2307.1.1
AF&PA—93	Span Tables for Joists and Rafters. . . . .	2306.1.1, 2308.8, 2308.10.2, 2308.10.3
ANSI/AF&PA PWF—07	Permanent Wood Foundation Design Specification. . . . .	1805.2, 1807.1.4, 2304.9.5.2
ANSI/AF&PA SDPWS—08	Special Design Provisions for Wind and Seismic . . . . .	1613.6.1, 2305.1, 2306.1, 2306.2.1, 2306.2.2, 2306.2.3, 2306.3, Table 2306.3, 2306.4, 2306.5, 2306.6, 2306.7, Table 2306.7, 2307.1, 2307.1.1

## AISC

American Institute of Steel Construction  
One East Wacker Drive, Suite 700  
Chicago, IL 60601-18021

Standard reference number	Title	Referenced in code section number
341—10	Seismic Provisions for Structural Steel Buildings, including Supplement No. 1 dated 2005. . . . .	1613.6.2, 1705A.2.1, 1707.2.2, 1708.3, 2212.2, 2205A, 2205.2.1, 2205.2.2, 2205.3, 2205.3.1, 2206A
358-10	<i>Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications including Supplement No. 1</i> . . . . .	2205A, 2206A.2, 2212.3, 3413A
360—10	Specification for Structural Steel Buildings . . . . .	1604.3.3, Table 1704.3, 1704.3.3, 1705A.2.1, Table 1705A.2.1, 2203.1, 2203.2, 2204A.2.2, 2205.1, 2205.3, 2206A.2, 2212.1.1, 2212.3, 2212A.1.2, 2212A.2.1

## AISI

American Iron and Steel Institute  
1140 Connecticut Avenue, 705  
Suite 705  
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
S100—07/S2-10	North American Specification for the Design of Cold-formed Steel Structural Members . . . . .	1604.3.3, 1905A.1, 1913.3.8, 2203.1, 2203.2, 2209.1, 2210A.2, 2210.2, 2210.4, 2210.5, 2211A.1, 2212A.1.2
S200—07	North American Standard for Cold-formed Steel Framing—General Provisions . . . . .	2203.1, 2203.2, 2210.1
S210—07	North American Standard for Cold-formed Steel Framing—Floor and Roof System Design. . . . .	2210.5
S211—07	North American Standard for Cold-formed Steel Framing—Wall Stud Design . . . . .	2210.4
S212—07	North American Standard for Cold-formed Steel Framing—Header Design . . . . .	2210.2
S213—07	North American Standard for Cold-formed Steel Framing—Lateral Designn, with Supplement 2, dated 2010. . . . .	2210.6, 2212A.2.1, 2212.5.3
S214—07	North American Standard for Cold-formed Steel Framing—Truss Design, with Supplement 2, dated 2008 . . . . .	2210.3.11, 2211A.3, 2212.5.1.2
S230—07	Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, with Supplement 2, dated 2008 . . . . .	1609.1.1, 1609.1.1.1, 2210.7

# AITC

American Institute of Timber Construction  
Suite 140  
7012 S. Revere Parkway  
Englewood, CO 80112

Standard reference number	Title	Referenced in code section number
AITC Technical Note 7—96	Calculation of Fire Resistance of Glued Laminated Timbers . . . . .	721.6.3.3
AITC 104—03	Typical Construction Details . . . . .	2306.1
AITC 110—01	Standard Appearance Grades for Structural Glued Laminated Timber . . . . .	2306.1
AITC 111—05	<i>Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection</i> . . . . .	2303.1.3.1
AITC 113—01	Standard for Dimensions of Structural Glued Laminated Timber . . . . .	2306.1
AITC 117—10	Standard Specifications for Structural Glued Laminated Timber of Softwood Species . . . . .	2303.1.3.1, 2306.1
AITC 119—96	Standard Specifications for Structural Glued Laminated Timber of Hardwood Species . . . . .	2306.1
AITC 200—04	Manufacturing Quality Control Systems Manual for Structural Glued Laminated Timber . . . . .	2306.1
AITC 404—05	<i>Standard for Radially Reinforcing Curved Glued Laminate Timber Members to Resist Radial Tension</i> . . . . .	2303.1.3.1
ANSI/AITC A 190.1—07	Structural Glued Laminated Timber . . . . .	1705A.5.4, 2303.1.3, 2306.1

# ALI

Automotive Lift Institute  
P.O. Box 85  
Courtland, NY 13045

Standard reference number	Title	Referenced in code section number
ALI ALCTV—2006	Standard for Automobile Lifts—Safety Requirements for Construction, Testing and Validation (ANSI) . . . . .	3001.2

# ANSI

American National Standards Institute  
25 West 43rd Street, Fourth Floor  
New York, NY 10036

Standard reference number	Title	Referenced in code section number
A13.1—96 (Reaffirmed 2002)	Scheme for the Identification of Piping Systems . . . . .	415.8.6.4
A108.1A—99	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar . . . . .	2103.10
A108.1B—99	Installation of Ceramic Tile, quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-portland Mortar . . . . .	2103.10
A108.4—99	Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive . . . . .	2103.10.6
A108.5—99	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-portland Cement Mortar . . . . .	2103.10.1, 2103.10.2
A108.6—99	Installation of Ceramic Tile with Chemical-resistant, Water Cleanable Tile-setting and -grouting Epoxy . . . . .	2103.10.3
A108.8—99	Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout . . . . .	2103.10.4
A108.9—99	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout . . . . .	2103.10.5
A108.10—99	Installation of Grout in Tilework . . . . .	2103.10.7
A118.1—99	American National Standard Specifications for Dry-set Portland Cement Mortar . . . . .	2103.10.1
A118.3—99	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile- setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive . . . . .	2103.10.3
A118.4—99	American National Standard Specifications for Latex-portland Cement Mortar . . . . .	2103.10.2
A118.5—99	American National Standard Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation . . . . .	2103.10.4
A118.6—99	American National Standard Specifications for Cement Grouts for Tile Installation . . . . .	2103.10.7
A118.8—99	American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout . . . . .	2103.10.5
A136.1—99	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile . . . . .	2103.10.6
A137.1—88	American National Standard Specifications for Ceramic Tile . . . . .	2103.5
A208.1—99	Particleboard . . . . .	2303.1.7, 2303.1.7.1
S3.41	<i>American National Standard Specifications for Audible Emergency Evacuation Signal</i> . . . . .	907.5.2.1.3
Z 97.1—09	Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test . . . . .	2406.1.2, 2406.2, Table 2406.2(2), 2406.3.1, 2407.1, 2407.1.4.1, 2408.2.1, 2408.3, 2409.1, 2409.2, 2409.3.1

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### APA

APA - Engineered Wood Association  
7011 South 19th  
Tacoma, WA 98466

Standard reference number	Title	Referenced in code section number
APA PDS—04	Panel Design Specification . . . . .	2306.1
APA PDS Supplement 1—90	Design and Fabrication of Plywood Curved Panels (revised 1995) . . . . .	2306.1
APA PDS Supplement 2—92	Design and Fabrication of Plywood-lumber Beams (revised 1998) . . . . .	2306.1
APA PDS Supplement 3—90	Design and Fabrication of Plywood Stressed-skin Panels (revised 1996) . . . . .	2306.1
APA PDS Supplement 4—90	Design and Fabrication of Plywood Sandwich Panels (revised 1993) . . . . .	2306.1
APA PDS Supplement 5—95	Design and Fabrication of All-plywood Beams (revised 1995) . . . . .	2306.1
EWS R540—02	Builders Tips: Proper Storage and Handling of Glulam Beams . . . . .	2306.1
EWS S475—01	Glued Laminated Beam Design Tables . . . . .	2306.1
EWS S560—03	Field Notching and Drilling of Glued Laminated Timber Beams . . . . .	2306.1
EWS T300—05	Glulam Connection Details . . . . .	2306.1
EWS X440—03	Product Guide—Glulam . . . . .	2306.1
EWS X450—01	Glulam in Residential Construction—Western Edition . . . . .	2306.1

### APSP

The Association of Pool & Spa Professionals  
2111 Eisenhower Avenue  
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
ANSI/APSP 7—06	Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs and Catch Basins . . . . .	3109.5

### ASABE

American Society of Agricultural and Biological Engineers  
2950 Niles Road  
St. Joseph, MI 49085

Standard reference number	Title	Referenced in code section number
EP 484.2 (2003)	Diaphragm Design of Metal-clad, Post-frame Rectangular Buildings . . . . .	2306.1
EP 486.1 (2000)	Shallow-post Foundation Design . . . . .	2306.1
EP 559 (1997)	Design Requirements and Bending Properties for Mechanically Laminated Columns . . . . .	2306.1

### ASCE/SEI

American Society of Civil Engineers  
Structural Engineering Institute  
1801 Alexander Bell Drive  
Reston, VA 20191-4400

Standard reference number	Title	Referenced in code section number
3—91	Structural Design of Composite Slabs . . . . .	1604.3.3, 2209.2.1
5—11	Building Code Requirements for Masonry Structures . . . . .	1405.6, 1405.6.2, 1405.10, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1704.5.3, 1807.1.6.3.2, 1808.9, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2109.2.1, 2109.3, 2110.1, 2114.10, 2114.11
6—08	Specification for Masonry Structures . . . . .	1405.6.1, Table 1704.5.1, Table 1704.5.3, 1807.1.6.3, 2103.8, 2103.11, 2103.12, 2103.13, 2104.1, 2104.1.1, 2104.1.2, 2104.1.3, 2104.2, 2104.3, 2104.4, 2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3

7—10		ASCE—continued
	Minimum Design Loads for Buildings and Other Structures including Supplements No. 1 and 2, excluding Chapter 14 and Appendix 11A. . . . .	104.11, 202, Table 1504.8, 1509.7.1, 1602.1, 1604.3, 1604.8.2, 1604.10, 1605.1, 1605.2.2, 1605.3.1.2, 1605.3.2, 1607.11.1, 1608.1, 1608.2, 1609.1.1, 1609.1.1.2.1, 1609.1.1.2.2, 1609.1.2, 1609.3, 1609.4.4, 1609.5.1, 1609.5.3, 1609.6, 1609.6.1, 1609.6.1.1, 1609.6.2, Table 1609.6.2(2), 1609.6.3, 1609.6.4.1, 1609.6.4.2, 1611.2, 1612.2, 1612.4, 1613.1, 1613.2, Table 1613.5.3(1), Table 1613.5.3(2), 1613.5.6, 1613.5.6.1, 1613.5.6.2, 1613.6, 1613.6.1, 1613.6.2, 1613.6.3, 1613.6.4, 1613.6.5, 1613.6.6, 1613.6.7, 1613.7, 1603A.2 1613A, 1616A, 1616.9, 1616.10, 1702.1, 1705.3.4, 1708.1, 1708.5, 1803A.6, 1808.3.1, 1810.3.6.1, 1810.3.9.4, 1810.3.11.2, 1810.3.12, 1905A.1.21, 1908.1.1, 1908.1.2, 1908.1.9, 1913.3.8, 2114A.1, 2114.13, 2205.2.1, 2205.3, 2205.3.1, 2208.1, 2210A.2, 2212A.2.4, Table 2304.6.1, Table 2306.7, Table 2308.10.1, 2404.1, 2410.1.1, 2410.1.2, 2505.1, 2505.2, 3404.4, 3404.5, 3419.7.2
8—02	Standard Specification for the Design of Cold-formed Stainless Steel Structural Members . . . . .	1604.3.3, 2209.1
19—10	Structural Applications of Steel Cables for Buildings . . . . .	2207.1, 2207.2
24—05	Flood Resistant Design and Construction . . . . .	1203.3.2, 1612.4, 1612.5, 3001.2, G103.1, G401.3, G401.4
29—05	Standard Calculation Methods for Structural Fire Protection. . . . .	721.1
32—01	Design and Construction of Frost Protected Shallow Foundations . . . . .	1809.5
41—06	Seismic Rehabilitation of Existing Buildings including Supplement No. 1. . . . .	1603A.2, 1616A.1.30, 3401.5, 3412A, 3413A, 3417.5, 3417.8, 3418.1, 3419.1, 3419.2, 3419.5, 3419.7.2, 3419.8, 3419.9, 3420.1, 3421.2.2, 3412A, 3413A

# ASME

American Society of Mechanical Engineers  
Three Park Avenue  
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A17.1/CSA B44—2007 (with A17.1a/CSA B44a—08 addenda)	Safety Code for Elevators and Escalators . . . . .	907.3.3, 911.1.5, 1007.4, 11B-407.1, 11B-407.2.2, 11B-407.4.9, 11B-408.1, 11B-409.1, 11B-410.1, 11B-810.9, 1607.8.1, 1607.9.1, 1613.6.5, 3001.2, 3001.4, 3002.5, 3003.2, 3007.1, 3007.2, 3008.2, 3008.2.1, 3008.7.6, 3008.8.1, 3411.8.2
A18.1—2008	Safety Standard for Platform Lifts and Stairway Chairlifts . . . . .	2702.2.6, 3411.8.3
A90.1—03	Safety Standard for Belt Manlifts . . . . .	3001.2
B16.18—2001 (Reaffirmed 2005)	Cast Copper Alloy Solder Joint Pressure Fittings . . . . .	909.13.1
B16.22—2001 (Reaffirmed 2005)	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings. . . . .	909.13.1
B20.1—2006	Safety Standard for Conveyors and Related Equipment . . . . .	3001.2, 3005.3
BPE—2009	Bio-processing Equipment Standard	
B31.3—2004	Process Piping . . . . .	415.8.6.1

# ASTM

ASTM International  
100 Barr Harbor Drive  
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
A 36/A 36M—05	Specification for Carbon Structural Steel . . . . .	1810.3.2.3
A 153/A 153M—05	Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware . . . . .	2304, 2304.9.5
A227—06 (2011)	Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs . . . . .	1211.1.1
A229—12	Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs . . . . .	1211.1.1
A 240/A 240M—07	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications . . . . .	Table 1507.4.3(1)
A 252—98 (2002)	Specification for Welded and Seamless Steel Pipe Piles . . . . .	1810.3.2.3
A 283/A 283M—03	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates . . . . .	1810.3.2.3
A 307—04e01	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength . . . . .	1911.1
A370—10	Standard Test Methods and Definitions for Mechanical Testing of Steel Products. . . . .	3413A.1.3
A 416/A 416M—06	Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete. . . . .	1810.3.2.2
A 463/A 463M—05	Standard Specification for Steel Sheet, Aluminum-coated, by the Hot-dip Process. . . . .	Table 1507.4.3(2)
A 572/A 572M—07	Specification for High-strength Low-alloy Columbium-vanadium Structural Steel . . . . .	1810.3.2.3
A 588/A 588M—05	Specification for High-strength Low-alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 inches (100 mm) Thick . . . . .	1810.3.2.3
A 615/A 615M—04a	Specification for Deformed and Plain Billet-steel Bars for Concrete Reinforcement. . . . .	1708.2, 1810.3.10.2
A 653/A 653M—07	Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process . . . . .	Table 1507.4.3(1), Table 1507.4.3(2), 2304.9.5.1

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A 690/A 690M—07	Standard Specification for High-strength Low-alloy Nickel, Copper, Phosphorus Steel H-piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments. . . . .	1810.3.2.3
A 706/A 706M—05a	Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement . . . . .	Table 1704.3, 1704.4.1, 2107.4, 2108.3
A 722/A 722M—07	Specification for Uncoated High-strength Steel Bar for Prestressing Concrete. . . . .	1810.3.10.2, <i>J106.2.4.2, 1811A.4</i>
A 755/A 755M—03	Specification for Steel Sheet, Metallic-coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products. . . . .	Table 1507.4.3(1), Table 1507.4.3(2)
A 792/A 792M—06a	Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process . . . . .	Table 1507.4.3(1), Table 1507.4.3(2)
A 875/A 875M—06	Standard Specification for Steel Sheet Zinc-5 percent, Aluminum Alloy-coated by the Hot-dip Process. . . . .	Table 1507.4.3(2)
A 913/A 913M—04	Specification for High-strength Low-alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-tempering Process (QST) . . . . .	1810.3.2.3
A 924/A 924M—07	Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process. . . . .	Table 1507.4.3(1)
A 992/A 992M—06a	Standard Specification for Structural Shapes . . . . .	1810.3.2.3
B 42—02e01	Specification for Seamless Copper Pipe, Standard Sizes . . . . .	909.13.1
B 43—98 (2004)	Specification for Seamless Red Brass Pipe, Standard Sizes . . . . .	909.13.1
B 68—02	Specification for Seamless Copper Tube, Bright Annealed (Metric) . . . . .	909.13.1
B 88—03	Specification for Seamless Copper Water Tube. . . . .	909.13.1
B 101—02	Specification for Lead-coated Copper Sheet and Strip for Building Construction. . . . .	Table 1404.5.3, Table 1507.2.9.2, Table 1507.4.3(1)
B 209—06	Specification for Aluminum and Aluminum Alloy Steel and Plate . . . . .	Table 1507.4.3(1)
B 251—02e01	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube. . . . .	909.13.1
B 280—03	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service . . . . .	909.13.1
B 370—03	Specification for Cold-rolled Copper Sheet and Strip for Building Construction . . . . .	1404.5.2, Table 1507.2.9.2, Table 1507.4.3(1)
B 695—04	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel . . . . .	<i>2304.9.1.1, 2304.9.5.1, 2304.9.5.3</i>
C 5—03	Specification for Quicklime for Structural Purposes . . . . .	Table 2507.2
C 22/C 22M—00 (2005)e01	Specification for Gypsum . . . . .	Table 2506.2
C 27—98 (2002)	Specification for Standard Classification of Fireclay and High-alumina Refractory Brick. . . . .	2111.5
C 28/C 28M—00 (2005)	Specification for Gypsum Plasters . . . . .	Table 2507.2
C 31/C 31M—06	Practice for Making and Curing Concrete Test Specimens in the Field. . . . .	Table 1704.4
C 33—03	Specification for Concrete Aggregates . . . . .	721.3.1.4, 721.4.1.1.3
C 34—03	Specification for Structural Clay Load-bearing Wall Tile . . . . .	2103.2
C 35—01 (2005)	Specification for Inorganic Aggregates for Use in Gypsum Plaster . . . . .	Table 2507.2
C 36/C 36M—03	Specification for Gypsum Wallboard . . . . .	Figure 721.5.1(2), Figure 721.5.1(3), Table 2506.2
C 37/C 37M—01	Specification for Gypsum Lath . . . . .	Table 2507.2
C 55—06e01	Specification for Concrete Building Brick . . . . .	Table 721.3.2, 2103.1, 2105.2.2.1.2
C 56—05	Specification for Structural Clay Nonload Bearing Tile . . . . .	2103.2
C 59/C 59M—00 (2006)	Specification for Gypsum Casting and Molding Plaster. . . . .	Table 2507.2
C 61/C 61M—00 (2006)	Specification for Gypsum Keene's Cement . . . . .	Table 2507.2
C 62—05	Specification for Building Brick (Solid Masonry Units Made from Clay or Shale). . . . .	1807.1.6.3, 2103.2, 2105.2.2.1.1
C 67—07	Test Methods of Sampling and Testing Brick and Structural Clay Tile . . . . .	721.4.1.1.1, 2109.3.1.1
C 73—05	Specification for Calcium Silicate Face Brick (Sand-lime Brick) . . . . .	Table 721.3.2, 2103.1
C 79—04a	Specification for Treated Core and Nontreated Core Gypsum Sheathing Board . . . . .	Table 2506.2
C 90—06b	Specification for Loadbearing Concrete Masonry Units . . . . .	Table 721.3.2, 1807.1.6.3, 2103.1
C 91—05	Specification for Masonry Cement . . . . .	Table 2507.2
C 94/C 94M—07	Specification for Ready-mixed Concrete. . . . .	110.3.1, <i>1705A.3.3</i>
<i>C 114—10</i>	<i>Standard Test Methods for Chemical Analysis of Hydraulic Cement . . . . .</i>	<i>1903A.6, 1913.2.3</i>
C 126—99 (2005)	Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick and Solid Masonry Units . . . . .	2103.2
C 140—07	Test Method Sampling and Testing Concrete Masonry Units and Related Units. . . . .	721.3.1.2
<i>C 144—04</i>	<i>Standard Specification for Aggregate for Masonry Mortar. . . . .</i>	<i>2103A.8</i>
C 150—07	Specification for Portland Cement . . . . .	<i>1903A, 1913A, 1913.2</i> , Table 2507.2
C 172—04	Practice for Sampling Freshly Mixed Concrete . . . . .	Table 1704.4
C 199—84 (2005)	Test Method for Pier Test for Refractory Mortars . . . . .	2111.5, 2111.8, 2113.12
C 206—03	Specification for Finishing Hydrated Lime. . . . .	Table 2507.2
C 208—95 (2001)	Specification for Cellulosic Fiber Insulating Board . . . . .	Table 1508.2, 2303.1.5
C 212—00 (2006)	Specification for Structural Clay Facing Tile . . . . .	2103.2
C 216—07	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) . . . . .	1807.1.6.3, 2103.2, 2105.2.2.1.1
C 270—08a	Specification for Mortar for Unit Masonry . . . . .	2103.8, <i>2114.2</i>
C 289—07	<i>Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates. . . . .</i>	<i>1903A.3, 1913.2.3</i>



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C 315—07	Specification for Clay Flue Liners and Chimney Pots . . . . .	2111.8, 2113.11, Table 2113.16(1)
C 317/C 317M—00 (2005)	Specification for Gypsum Concrete . . . . .	1914.1
C 330—05	Specification for Lightweight Aggregates for Structural Concrete . . . . .	721.1.1
C 331—05	Specification for Lightweight Aggregates for Concrete Masonry Units . . . . .	721.3.1.4, 721.4.1.1.3
C 406—06e01	Specification for Roofing Slate . . . . .	1507.7.5
C 442/C 442M—04	Specification for Gypsum Backing Board and Coreboard and Gypsum Shaftliner Board. . . . .	Table 2506.2
C 472—99 (2004)	Specification for Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete . . . . .	Table 2506.2
C 473—06a	Test Method for Physical Testing of Gypsum Panel Products . . . . .	Table 2506.2
C 474—05	Test Methods for Joint Treatment Materials for Gypsum Board Construction. . . . .	Table 2506.2
C 475—05	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard . . . . .	Table 2506.2
C 503—05	Specification for Marble Dimension Stone (Exterior) . . . . .	2103.4
C 514—04	Specification for Nails for the Application of Gypsum Board . . . . .	Table 720.1(2), Table 720.1(3), Table 2306.7, Table 2506.2
C 516—02	Specifications for Vermiculite Loose Fill Thermal Insulation . . . . .	721.3.1.4, 721.4.1.1.3
C 547—06	Specification for Mineral Fiber Pipe Insulation . . . . .	Table 720.1(2), Table 720.1(3)
C 549—06	Specification for Perlite Loose Fill Insulation . . . . .	721.3.1.4, 721.4.1.1.3
C 552—03	Standard Specification for Cellular Glass Thermal Insulation . . . . .	Table 1508.2
C 557—03e01	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing. . . . .	Table 2506.2
C 568—03	Specification for Limestone Dimension Stone . . . . .	2103.4
C 578—07	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation. . . . .	Table 1508.2
C 587—04	Specification for Gypsum Veneer Plaster . . . . .	Table 2507.2
C 588/C 588M—01	Specification for Gypsum Base for Veneer Plasters . . . . .	Table 2507.2
C 595—08a	Specification for Blended Hydraulic Cements . . . . .	1903A.6, 1913A.1, 1913.2, Table 2507.2
C 615—03	Specification for Granite Dimension Stone . . . . .	2103.4
C 616—03	Specification for Quartz Dimension Stone . . . . .	2103.4
C 618—08a	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete. . . . .	1903A.3, 1913A.1, 1913.2
C 629—03	Specification for Slate Dimension Stone . . . . .	2103.4
C 630/C 630M—03	Specification for Water-resistant Gypsum Backing Board . . . . .	Table 2506.2
C 631—95a (2004)	Specification for Bonding Compounds for Interior Gypsum Plastering. . . . .	Table 2507.2
C 635/C 635M—07	Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings . . . . .	808.1.1, 1616.10.16, 1616A.1.20, 2506.2.1, H107.1.1
C 636/C 636M—08	Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels . . . . .	808.1.1, 1616.10.16, 1616A.1.20
C 645—07	Specification for Nonstructural Steel Framing Members. . . . .	Table 2506.2, Table 2507.2
C 652—05a	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale) . . . . .	1807.1.6.3, 2103.2, 2105.2.2.1.1
C 728—05	Standard Specification for Perlite Thermal Insulation Board. . . . .	Table 1508.2
C 744—05	Specification for Prefaced Concrete and Calcium Silicate Masonry Units . . . . .	Table 721.3.2, 2103.1
C 754—04	Specification for Installation of Steel Framing Members to Receive Screw-attached Gypsum Panel Products. . . . .	Table 2508.1, Table 2511.1.1
C 836—06	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course . . . . .	1507.15.2
C 840—07	Specification for Application and Finishing of Gypsum Board. . . . .	Table 2508.1, 2509.2
C 841—03	Specification for Installation of Interior Lathing and Furring. . . . .	Table 2508.1, Table 2511.1.1
C 842—05	Specification for Application of Interior Gypsum Plaster . . . . .	Table 2511.1.1, 2511.3, 2511.4
C 843—99 (2006)	Specification for Application of Gypsum Veneer Plaster . . . . .	Table 2511.1.1
C 844—04	Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster . . . . .	Table 2508.1
C 847—06	Specification for Metal Lath . . . . .	Table 2507.2
C 887—05	Specification for Packaged, Dry Combined Materials for Surface Bonding Mortar . . . . .	1805.2.2, 2103.9
C 897—05	Specification for Aggregate for Job-mixed Portland Cement-based Plaster. . . . .	Table 2507.2
C 920—05	Standard for Specification for Elastomeric Joint Sealants . . . . .	Table 2506.2
C 926—98a (2005)	Specification for Application of Portland Cement-based Plaster. . . . .	2109.3.4.6, 2510.3, Table 2511.1.1, 2511.3, 2511.4, 2512.1, 2512.1.2, 2512.2, 2512.6, 2512.8.2, 2512.9, 2513.7
C 931/C 931M—04	Specification for Exterior Gypsum Soffit Board. . . . .	Table 2506.2
C 932—06	Specification for Surface-applied Bonding Compounds Agents for Exterior Plastering . . . . .	Table 2507.2
C 933—05	Specification for Welded Wire Lath . . . . .	Table 2507.2
C 946—91 (2001)	Specification for Practice for Construction of Dry-stacked, Surface-bonded Walls . . . . .	2103.9, 2109.2.2



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C 954—04	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch (0.84 mm) to 0.112 inch (2.84 mm) in Thickness . . . . .	Table 2506.2, Table 2507.2
C 955—06	Standard Specification for Load-bearing Transverse and Axial Steel Studs, Runners Tracks, and Bracing or Bridging, for Screw Application of Gypsum Panel Products and Metal Plaster Bases . . . . .	Table 2506.2, Table 2507.2
C 956—04	Specification for Installation of Cast-in-place Reinforced Gypsum Concrete . . . . .	1914.1
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C 1178/C 1178M—06	Specification for Coated Mat Water-resistant Gypsum Backing Panel . . . . .	Table 2506.2, 2509.2
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D 1557—02e01	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lb/ft <sup>3</sup> (2,700 KN m/m <sup>3</sup> )] . . . . .	1704.7, 1804.5, J107.6
D 1586—11	<i>Standard Test Method for Standard for Penetration Test (SPT) and Split-barrel Sampling of Soils</i> . . . . .	J112.2
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G 155—05a	Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials . . . . .	1504.6



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Standard reference number	Title	Referenced in code section number
12-B—98	Technical Manual 12-B Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-resistive Materials; an Annotated Guide, First Edition . . . . .	1704.13

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### AWPA

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Standard reference number	Title	Referenced in code section number
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M4—06	Standard for the Care of Preservative-treated Wood Products . . . . .	1810.3.2.4.1, 2303.1.8
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Miami, FL 33126

Standard reference number	Title	Referenced in code section number
<i>D1.1—10</i>	<i>Structural Welding Code—Steel</i> . . . . .	Table 1704.3, 1704.3.1.1, <i>Table 1705A.2.1</i> , <i>1705A.2.2.5</i> , <i>2212.6.2</i> , <i>2213A.2</i>
D1.3—08	Structural Welding Code—Sheet Steel . . . . .	Table 1704.3, 1704.3.1.2, <i>Table 1705A.2.1</i> , <i>1705A.2.2.1.1</i>
D1.4—11	Structural Welding Code—Reinforcing Steel . . . . .	Table 1704.3, 1704.3.1.3, Table 1704.4, <i>Table 1705A.2.1</i> , <i>1705.2.2.1.2</i> , <i>2107A.3</i> , <i>2107A.4</i>
<i>D1.8—09</i>	<i>Structural Welding Code – Seismic Supplement</i> . . . . .	<i>1704A.3.1.4</i> , <i>1705A.2.2.5</i> , <i>2204A.1.1</i> , <i>2204A.1.3</i> , <i>2211.1</i>
<i>QC1—06</i>	<i>Standard for AWS Certification of Welding Inspectors</i> . . . . .	<i>1704A.3.1.4</i> , <i>1705A.2.2.5</i>

### BHMA

Builders Hardware Manufacturers' Association  
355 Lexington Avenue, 17th Floor  
New York, NY 10017-6603

Standard reference number	Title	Referenced in code section number
A 156.10—11	Power Operated Pedestrian Doors . . . . .	11B-404.2.9, 11B-404.3, 1008.1.4.2
A 156.19—07	Standard for Power Assist and Low Energy Operated Doors . . . . .	11B-404.2.9, 11B-404.3, 11B-408.3.2.1, 11B-409.3.1, 1008.1.4.2

### CGSB

Canadian General Standards Board  
Place du Portage 111, 6B1  
11 Laurier Street  
Gatineau, Quebec, Canada KIA 1G6

Standard reference number	Title	Referenced in code section number
37-GP-52M (1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric . . . . .	1504.7, 1507.12.2
37-GP-56M (1980)	Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing—with December 1985 Amendment . . . . .	1507.11.2
CAN/CGSB 37.54—95	Polyvinyl Chloride Roofing and Waterproofing Membrane . . . . .	1507.13.2

### CPA

Composite Panel Association  
19465 Deerfield Avenue, Suite 306  
Leesburg, VA 20176

Standard reference number	Title	Referenced in code section number
ANSI A135.4—2004	Basic Hardboard . . . . .	1404.3.1, 2303.1.6
ANSI A135.5—2004	Prefinished Hardboard Paneling . . . . .	2303.1.6, 2304.6.2
ANSI A135.6—1998	Hardboard Siding . . . . .	1404.3.2, 2303.1.6

# CPSC

Consumer Product Safety Commission  
4330 East West Highway  
Bethesda, MD 20814-4408

Standard reference number	Title	Referenced in code section number
16 CFR Part 1201 (2002)	Safety Standard for Architectural Glazing Material . . . . .	2406.2, Table 2406.2(1), 2406.3.1, 2407.1, 2407.1.4.1, 2408.2.1, 2408.3, 2409.1, 2409.2, 2409.3.1
16 CFR Part 1209 (1979)	Interim Safety Standard for Cellulose Insulation . . . . .	719.6
16 CFR Part 1404 (1979)	Cellulose Insulation. . . . .	719.6
16 CFR Part 1500 (1991)	Hazardous Substances and Articles; Administration and Enforcement Regulations . . . . .	307.2
16 CFR Part 1500.44 (2001)	Method for Determining Extremely Flammable and Flammable Solids . . . . .	307.2
16 CFR Part 1507 (2001)	Fireworks Devices. . . . .	307.2
16 CFR Part 1630 (2000)	Standard for the Surface Flammability of Carpets and Rugs. . . . .	804.4.1

# CSA

Canadian Standards Association  
5060 Spectrum Way  
Mississauga, Ontario Canada L4W 5N6

Standard reference number	Title	Referenced in code section number
101/I.S.2/A440—08	Specifications for Windows, Doors and Unit Skylights . . . . .	1715.5.1, 2405.5

# CSSB

Cedar Shake and Shingle Bureau  
P. O. Box 1178  
Sumas, WA 98295-1178

Standard reference number	Title	Referenced in code section number
CSSB—97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau. . . . .	Table 1507.8.5, Table 1507.9.6

# DASMA

Door and Access Systems Manufacturers Association International  
1300 Summer Avenue  
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
ANSI/DASMA 107—1997 (R2004)	Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation . . . . .	2603.4.1.9
108—05	Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference. . . . .	1715.5.2
115—05	Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure . . . . .	1609.1.2.2

# DOC

U.S. Department of Commerce  
National Institute of Standards and Technology  
1401 Constitution Avenue NW  
Washington, DC 20230

Standard reference number	Title	Referenced in code section number
PS-1—07	Structural Plywood. . . . .	2303.1.4, 2304.6.2, Table 2304.7(4), Table 2304.7(5), Table 2306.2.1(1), Table 2306.2.1(2)
PS-2—04	Performance Standard for Wood-based Structural-use Panels . . . . .	2303.1.4, 2304.6.2, Table 2304.7(5), Table 2306.2.1(1), Table 2306.2.1(2)
PS 20—05	American Softwood Lumber Standard. . . . .	1810.3.2.4, 2302.1, 2303.1.1

## REFERENCED STANDARDS

### DOJ

U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Civil Rights Division, Disability Rights Section-NYA  
Washington, DC 20530

Standard reference number	Title	Referenced in code section number
DOJ 36 CFR Part 1192	American with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles (ADAAG) Department of Justice, 1991 . . . . .	E109.2.4

### DOL

U.S. Department of Labor  
c/o Superintendent of Documents  
U.S. Government Printing Office  
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
29 CFR Part 1910.1000 (1974)	Air Contaminants . . . . .	902.1

### DOTn

U.S. Department of Transportation  
c/o Superintendent of Documents  
1200 New Jersey Avenue, SE  
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
49 CFR Parts 100-185-2005	Hazardous Materials Regulations . . . . .	307.2
49 CFR Parts 173.137 (2005)	Shippers—General Requirements for Shipments and Packaging—Class 8—Assignment of Packing Group . . . . .	307.2
49 CFR—1998	Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335, UN 0336 Shipping Containers . . . . .	307.2

### EN

European Committee for Standardization (EN)  
Central Secretariat  
Rue de Stassart 36  
B-10 50 Brussels

Standard reference number	Title	Referenced in code section number
EN 1081-98	Resilient Floor Coverings—Determination of the Electrical Resistance . . . . .	406.5.2

### FEMA

Federal Emergency Management Agency  
Federal Center Plaza  
500 C Street S.W.  
Washington, DC 20472

Standard reference number	Title	Referenced in code section number
352—00	<i>Recommended Postearthquake Evaluation and Repair Criteria for Welded Steel Moment-frame Buildings</i> . . . . .	3419.2
FIA-TB11—01	Crawlspace Construction for Buildings Located in Special Flood Hazard Areas . . . . .	1805.1.2.1

# FM

Factory Mutual Global Research  
Standards Laboratories Department  
1301 Atwood Avenue, P.O. Box 7500  
Johnston, RI 02919

Standard reference number	Title	Referenced in code section number
<i>FM 1950—10</i>	<i>Approval Standard for Seismic Sway Braces for Automatic Sprinkler Systems</i> . . . . .	<i>1705A.12.3</i>
<i>3260—00</i>	<i>Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling.</i>	
<i>3011—99</i>	<i>Approval Standard for Central Station Service for Fire Alarm and Protective Equipment Supervision</i>	
<i>4430—80</i>	<i>Acceptance Criteria for Smoke and Heat Vents</i> . . . . .	<i>910.3.1</i>
4450 (1989)	Approval Standard for Class 1 Insulated Steel Deck Roofs—with Supplements through July 1992 . . . . .	1508.1, 2603.3, 2603.4.1.5
4470 (1992)	Approval Standard for Class 1 Roof Covers . . . . .	1504.7
4474 (04)	Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures . . . . .	1504.3.1
4880 (2005)	American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior and Exterior Finish Systems . . . . .	2603.4, 2603.9

# GA

Gypsum Association  
810 First Street N.E. #510  
Washington, DC 20002-4268

Standard reference number	Title	Referenced in code section number
GA 216—07	Application and Finishing of Gypsum Panel Products . . . . .	Table 2508.1, 2509.2
GA 600—06	Fire-resistance Design Manual, 18th Edition . . . . .	Table 720.1(1), Table 720.1(2), Table 720.1(3)

# HPVA

Hardwood Plywood Veneer Association  
1825 Michael Faraday Drive  
Reston, VA 20190

Standard reference number	Title	Referenced in code section number
HP-1—2004	Standard for Hardwood and Decorative Plywood. . . . .	2303.3, 2304.6.2

# HUD

U.S. Department of Housing and Urban Development  
451 7th Street, SW  
Washington, DC 20410

Standard reference number	Title	Referenced in code section number
HUD 24 CFR Part 3280 (1994)	Manufactured Home Construction and Safety Standards . . . . .	G201

# ICC

International Code Council, Inc.  
500 New Jersey Ave, NW  
6th Floor  
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
ICC 300—12	ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands . . . . .	1028.1.1, Table 1607.1, 3401.1
ICC 400—12	Standard on Design and Construction of Log Structures . . . . .	2301.2
ICC 500—08	ICC/NSSA Standard on the Design and Construction of Storm Shelters . . . . .	202, 423.1, 423.2
ICC 600—08	Standard for Residential Construction in High Wind Regions . . . . .	1609.1.1, 1609.1.1.1, 2308.2.1
<i>ICC-ES AC 01—12*</i>	<i>Acceptance Criteria for Expansion Anchors in Masonry Elements</i> . . . . .	<i>1616A.1.19</i>
<i>ICC-ES AC 58—12*</i>	<i>Acceptance Criteria for Adhesive Anchors in Masonry Elements</i> . . . . .	<i>1616A.1.19</i>
<i>ICC-ES AC 70—12*</i>	<i>Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements.</i> . . . . .	<i>1908A.1.1</i>
<i>ICC ES AC 77</i>	<i>Acceptance Criteria for Smoke Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames</i> . . . . .	<i>707.14.1</i>



REFERENCED STANDARDS

ICC—continued	
ICC-ES AC 106—12*	Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry . . . . . 1616A.1.19
ICC-ES AC 125—12*	Acceptance Criteria for Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems . . . . . 1914.3
ICC-ES AC 156—12	Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components . . . . . 1705A.12.4
ICC-ES AC 178—12*	Acceptance Criteria for Inspection and Verification of Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems . . . . . 1914A.3
ICC-ES AC 193—12*	Acceptance Criteria for Mechanical Anchors in Concrete Elements . . . . . 1616A.1.19, 1909A.11
ICC-ES AC 308—12	Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements . . . . . 1616A.1.19
ICC ES AC 331	Acceptance Criteria for Smoke and Heat Vents . . . . . 910.3.1
ICC-ES AC 358—12	Acceptance Criteria for Helical Foundation Systems and Devices . . . . . 1810A.3.1.5.1
SBCCI SSTD 11—97	Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles . . . . . 1716.2.1, 1716.2.2

\* Refers to International Building Code, 2012 as a reference standard.

ISO		International Organization for Standardization ISO Central Secretariat 1 ch, de la Voie-Creuse, Case Postale 56 CH-1211 Geneva 20, Switzerland
Standard reference number	Title	Referenced in code section number
ISO 8115—86	Cotton Bales—Dimensions and Density . . . . .	Table 415.8.2.1.1
ISO 9001—08	Quality Management Systems - Requirements . . . . .	1705A.12.4
ISO 17025—05	General Requirement for Competence of Testing and Calibration Laboratories . . . . .	1705A.12.4

NAAMM		National Association of Architectural Metal Manufacturers 800 Roosevelt Road, Bldg. C, Suite 312 Glen Ellyn, IL 60137
Standard reference number	Title	Referenced in code section number
FP 1001—97	Guide Specifications for Design of Metal Flag Poles . . . . .	1609.1.1

NCMA		National Concrete Masonry Association 13750 Sunrise Valley Herndon, VA 22071-4662
Standard reference number	Title	Referenced in code section number
TEK 5-84 (1996)	Details for Concrete Masonry Fire Walls . . . . .	Table 720.1(2)

NFPA		National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471
Standard reference number	Title	Referenced in code section number
11—10	Low-, Medium- and High-Expansion Foam . . . . .	904.7
12—05	Carbon Dioxide Extinguishing Systems . . . . .	904.8, 904.11
12A—04 Halon 1301	Halon 1301 Fire Extinguishing Systems . . . . .	904.9
13—13	Installation of Sprinkler Systems, as amended* . . . . .	708.2, 903.3.1.1, 903.3.2, 903.3.5.1.1, 903.3.5.2, 904.11, 905.3.4, 907.6.3, 1616.6.3, 1616.9.5, 1616.10.17

**\*NFPA 13, Amended Sections as follows:**  
**Revise Section 2.2 and add publications as follows:**  
**2.2 NFPA Publications.**  
NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2006 California edition.  
**Add a new definition as 3.4.1.1 to read as follows:**  
**3.4.1.1 Premixed Antifreeze Solution.** A mixture of an antifreeze material with water that is prepared by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

NFPA—continued

*Revise 7.6.1.5 to read as follows:*

**7.6.1.5** A placard shall be placed on the antifreeze system main valve that indicates the manufacture type and brand of the antifreeze solution, the concentration by volume of the antifreeze solution used, and the volume of the antifreeze solution used in the system.

*Revise 7.6.2.1 to read as follows:*

**7.6.2.1\*** Antifreeze solutions shall be limited to premixed antifreeze solutions of glycerin (chemically pure or United States Pharmacopoeia 96.5 percent) at a maximum concentration of 50 percent by volume, or propylene glycol at a maximum concentration of 40 percent by volume.

*Add a new 7.6.2.1.1 to read:*

**7.6.2.1.1** Premixed antifreeze solutions of propylene glycol exceeding 40 percent concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

*Add new 7.6.2.1.2 to read as follows:*

**7.6.2.1.2** Premixed antifreeze solutions other than those described in 7.6.2.1 that are listed for use in sprinkler systems shall be permitted to be used.

*Add a new 7.6.2.1.3 to read as follows:*

**7.6.2.1.3** All premixed antifreeze solutions shall be provided with a certificate from the manufacturer indicating the type of antifreeze, concentration by volume, and freezing point.

*Delete current Table 7.6.2.2 and replace it with the following table in the annex renumbered as Table A.7.6.2.1*

**A.7.6.2.1** See Table A.7.6.2.1.

TABLE A.7.6.2.1 PROPERTIES OF GLYCERIN AND PROPYLENE GLYCOL

MATERIAL	SOLUTION (by volume)	SPECIFIC GRAVITY AT 77°F (25°C)	FREEZING POINT	
			°F	°C
Glycerin (C.P. or U.S.P. grade)	0%	1.000	32	0
	5	1.014	31	-0.5
	10	1.029	28	-2.2
	15	1.043	25	-3.9
	20	1.059	20	-6.7
	25	1.071	16	-8.9
	30	1.087	10	-12
	35	1.100	4	-15.5
	40	1.114	-2	-19
	45	1.130	-11	-24
	50%	1.141	-19	-28
Propylene glycol	0%	1.000	32	0
	5	1.004	26	-3
	10	1.008	25	-4
	15	1.012	22	-6
	20	1.016	19	-7
	25	1.020	15	-10
	30	1.024	11	-12
	35	1.028	2	-17
	40%	1.032	-6	-21

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

*Delete 7.6.2.3 and Table 7.6.2.3.*

*Revise 7.6.2.4 to read as follows:*

**7.6.2.4** A premix antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be provided.

*Delete existing 7.6.2.5 as well as the Figures 7.6.2.5(a), 7.6.2.5(b), and 7.6.2.5(c) and Annex A.7.6.2.5.*

*Delete 7.6.2.6.*

*Add an asterisk to Section 7.6 and a new Annex A.7.6 to read as follows:*

**A.7.6** In cold climates and areas where the potential for freezing of pipes is a concern, options other than antifreeze are available. Such options include installing the pipe in warm spaces, tenting insulation over the piping (as illustrated in NFPA 13D), listed heat tracing, and the use of dry pipe systems and preaction systems.

*In A.7.6.2, delete the second paragraph.*

**A.7.6.2** Listed CPVC sprinkler pipe and fittings should be protected from freezing with glycerine only. The use of diethylene, ethylene, or propylene glycols is specifically prohibited. Laboratory testing shows that glycol-based antifreeze solutions present a chemical environment detrimental to CPVC.

NFPA—continued

*Delete existing A.7.6.2.4 and Figure A.7.6.2.4.*

*Revise Section 8.15.1.2.15 as follows:*

**8.15.1.2.15** Exterior columns under 10 ft<sup>2</sup> (0.93 m<sup>2</sup>) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.

**8.15.5.7** The sprinkler required at the top and bottom of the elevator hoistway by 8.15.5.6 shall not be required where permitted by Chapter 30 of the California Building Code.

*Revise Section 8.15.7.1\* as follows:*

**8.15.7.1\*** Unless the requirements of 8.15.7.2 or 8.15.7.3 are met, sprinklers shall be installed under exterior roofs, canopies, porte-cochere, balconies, decks, or similar projections exceeding 4 ft (1.2 m) in width.

*Revise Section 8.15.7.2\* as follows:*

**8.15.7.2\*** Sprinklers shall be permitted to be omitted where the canopies, roofs, balconies, decks, or similar projections are constructed with materials that are noncombustible, limited-combustible, or fire retardant treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials*.

*Delete Section A.8.15.7.2 of Annex*

*Revise Section 8.15.7.3*

**8.15.7.3** Sprinklers shall be permitted to be omitted from below the canopies, roofs, balconies, decks, or similar projections are combustible construction, provided the exposed finish material on the roof, or canopy, is noncombustible, limited-combustible, or fire retardant treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials*, and the roofs, or canopies contain only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:

- (1) Combustible concealed spaces filled entirely with noncombustible insulation
- (2) Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft<sup>3</sup> (4.5 m<sup>3</sup>) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic [See 11.2.3.1.4(4)(d)].
- (3) Concealed spaces over isolated small roofs, or canopies not exceeding 55 ft<sup>2</sup> (5.1 m<sup>2</sup>)

*Delete language to section 8.15.7.4 and reserve section number.*

**8.15.7.4**

*Revise Annex Section A.8.15.7.5 as follows:*

**A.8.15.7.5** The presence of planters, newspaper machines and similar items should not be considered storage.

*Add Section A.8.15.7.6 as follows:*

**8.15.7.6** Sprinklers may be omitted for following structures:

- (1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
- (2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

*Add new Sections 8.16.1.1.1.4 and 8.16.1.1.1.5 as follows:*

**8.16.1.1.1.4** Where a system includes floor control valves, a hydraulic design information sign containing information for the floor shall be provided at each floor control valve. A hydraulic design information sign shall be provided for each area calculated. The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area.

**8.16.1.1.1.5** Control valves, check valves, drain valves and antifreeze valves shall be readily accessible for inspection, testing and maintenance. Valves located more than 7 feet above the finished floor shall be provided with a means of opening and closing the valve from the floor level.

*Revise Section 8.16.1.5.1 as follows:*

**8.16.1.5.1** Private fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.

*Add new Sections 8.16.1.5.1.1, 8.16.1.5.1.2 and 8.16.1.5.1.3 as follows:*

**8.16.1.5.1.1** Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.

**8.16.1.5.1.2** Sectional control valves shall be indicating valves in accordance with Section 6.7.1.3.

NFPA—continued

**8.16.1.5.1.3** Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.

**8.16.1.5.1.4** The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.

**Revise Section 8.16.1.5.2 as follows:**

**8.16.1.5.2** A valve shall be provided on each bank where a main crosses a body of water or outside the building foundation(s) where the main or section of main runs under a building.

**Add new Section 9.1.3.9.1.1 as follows:**

**9.1.3.9.1.1** Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic Design Categories C, D, E and F.

Revise Section 9.3.5.8.3 as follows:

**9.3.5.8.3** Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.

**Replace Section 9.3.5.9.4 as follows:**

Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.

**Add language to the beginning of Section 9.3.5.9.6 as follows:**

**9.3.5.9.6** Fastening methods other than those identified in Section 9.3.5.9 shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 9.3.5.6. Calculations shall be submitted to the authority having jurisdiction.

**Revise Section 9.3.5.9.7.2\* as follows:**

**9.3.5.9.7.2\*** Concrete anchors other than those shown in Figure 9.3.5.9.1 and identified in Section 9.3.5.8.10 shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.

**Revise Section 9.3.6.1(3) as follows:**

**9.3.6.1\*(3)** No. 12, 440 lb (200Kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Powder-driven fasteners for attaching restraint is allowed to be used provided that the restraint component does not support the dead load.

**Revise Section 10.6.5 as follows:**

**10.6.5** Pipe joints shall not be located under foundation footings. The pipe under the building or building foundation shall not contain mechanical joints.

**Exceptions:**

1. Where allowed in accordance with Section 10.6.2
2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

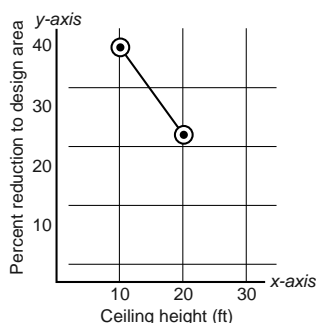
**Revise Section 11.2.3.1.4(4)(i) as follows:**

**11.2.3.1.4(4)(i)** Exterior columns under 10 ft<sup>2</sup> (0.93 m<sup>2</sup>) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system.

**Revise Section 11.2.3.2.3.1 as follows:**

**11.2.3.2.3.1** Where listed quick-response sprinklers, excluding extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 11.2.3.2.3.1 when all of the following conditions are satisfied:

- (1) Wet pipe system
- (2) Light hazard occupancy



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- (3) 20 ft (6.1 m) maximum ceiling height
- (4) There are no unprotected ceiling pockets as allowed by 8.6.7 and 8.8.7 exceeding 32 ft<sup>2</sup> (3 m<sup>2</sup>)

Note:  $y = \frac{-3x}{2} + 55$

For ceiling height  $\geq 10$  ft and  $\leq 20$  ft,  $y = \frac{-3x}{2} + 55$

For ceiling height  $< 10$  ft,  $y = 40$

For ceiling height  $> 20$  ft,  $y = 0$

For SI units, 1 ft = 0.31 m.

**FIGURE 11.2.3.2.3.1 Design Area Reduction for Quick-Response Sprinklers.**

*Revise Section 11.2.3.2.3.2 as follows:*

**11.2.3.2.3.2** The number of sprinklers in the design area shall never be less than *seven*.

**12.1.1.2** Early suppression fast-response (ESFR) sprinklers shall not be used in buildings with automatic heat or smoke vents unless the vents use a standard-response operating mechanism *with a minimum temperature rating of 360°F (182°C) or 100°F (56°C) above the operating temperature of the sprinklers, whichever is higher.*

*Add Section 24.1(5)*

**24.1 Approval of Sprinkler Systems and Private Fire Service Mains.**

The installing contractor shall do the following:

- (1) Notify the authority having jurisdiction and the property owner or property owner's authorized representative of the time and date testing will be performed.
- (2) Perform all required testing (*see Section 24.2*)
- (3) Complete and sign the appropriate contractor's material and test certificate(s) (*see Figure 24.1*)
- (4) Remove all caps and straps prior to placing the sprinkler system in service
- (5) *Upon system acceptance by the authority having jurisdiction a label prescribed by Title 19 California Code of Regulations, Chapter 5 shall be affixed to each system riser.*

*Revise Section 24.4(2) and add Section 24.4(3) as follows:*

**24.4 Instructions.**

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

- (1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed
- (2) *NFPA 25, Standard for the Inspection, testing, and maintenance of Water-Based Fire Protection Systems, 2006 California Edition*
- (3) *Title 19, California Code of Regulations, Chapter 5, "Fire Extinguishing Systems."*

*Add sentence at the end of Section 24.5.1 as follows:*

**24.5.1** *"Pipe schedule systems shall be provided with a sign indicating that the system was designed and installed as a pipe schedule system and the hazard classification(s) included in the design."*

*Revise Section 24.5.2(3) and add Sections 24.5.2(7) to (14) as follows:*

**24.5.2** The sign shall include the following information:

- (3) Required flow and pressure of the system at the base of the riser
- (7) *Required flow and pressure of the system at the water supply source.*
- (8) *Required flow and pressure of the system at the discharge side of the fire pump where a fire pump is installed.*

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- (9) Type or types and number of sprinklers or nozzles installed including the orifice size, temperature rating, orientation, K-Factor, sprinkler identification number (SIN) for sprinkler heads when applicable, and response type.
- (10) The minimum discharge flow rate and pressure required from the hydraulically most demanding sprinkler.
- (11) The required pressure settings for pressure reducing valves.
- (12) For deluge sprinkler systems, the required flow and pressure at the hydraulically most demanding sprinkler or nozzle.
- (13) The protection area per sprinkler based on the hydraulic calculations.
- (14) The edition of NFPA 13 to which the system was designed and installed.

**Revise Section 24.6.1 as follows:**

**24.6.1** California Edition NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings

and Manufactured Homes as amended\* . . . . . R313.1.1, R313.2.1, R313.3.1, R313.3.2,  
R313.3.2.3.1, R313.3.2.4.2, R313.3.6

**\*NFPA 13D, Amended Sections as follows:**

**Add a new definition as 3.3.9.1.1 and related annex note to read as follows:**

**3.3.9.1.1\* Premixed Antifreeze Solution.** A mixture of an antifreeze material with water that is prepared and factory-mixed by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous.

**A.3.3.9.1.1** Where a tank is used as the water supply for the sprinkler system, the tank is not permitted to be filled with antifreeze.

**Revise 4.1.4 and related annex note to read as follows:**

**4.1.4\* Antifreeze Systems.**

**A.4.1.4** Sampling from the top and bottom of the system helps to determine if the solution has settled. Antifreeze solutions are heavier than water. If the antifreeze compound is separating from the water due to poor mixing, it will exhibit a higher concentration in the lower portion of the system than in the upper portions of the system. If the concentration is acceptable near the top, but too low near the water connection, it may mean that the system is becoming diluted near the water supply. If the concentration is either too high or too low in both the samples, it may mean that the wrong concentration was added to the system.

On an annual basis, test samples should be drawn from test valve B as shown in Figure 8.3.3.2.1(1), especially if the water portion of the system has been drained for maintenance or repairs. A small hydrometer can be used so that a small sample is sufficient. Where water appears at valve B, or where the sample indicates that the solution has become weakened, the entire system should be emptied and refilled with acceptable solution as previously described.

Where systems are drained in order to be refilled, it is not typically necessary to drain drops that are less than 36 inches in length. Most systems with drops have insufficient volume to cause a problem, even if slightly higher concentration solutions collect in the drops. For long drops with significant volume, consideration should be given to draining drops if there is evidence that unacceptably high concentrations of antifreeze have collected in these long drops.

When emptying and refilling antifreeze solutions, every attempt should be made to recycle the old solution with the antifreeze manufacturer rather than discarding it.

**4.1.4.1 Annual Antifreeze Solution Test and Replacement Procedure.**

**4.1.4.1.1** Samples of antifreeze solution should be collected by qualified individuals in accordance with 4.1.4.1.1.1 or 4.1.4.1.1.2 on an annual basis.

**4.1.4.1.1.1** The system shall be drained to verify that (a) the solution is in compliance with 8.3.3, and (b) the solution provides the necessary freeze protection. Solution samples shall be taken near the beginning and near the end of the draining process.

**4.1.4.1.1.2\*** Solution samples shall be taken at the highest practical elevation and the lowest practical elevation of the system.

**A.4.1.4.1.1.2** If not already present, test connections (valves) for collection of solution samples should be installed at the highest and lowest practical locations of the system or portion of the system containing antifreeze solution.

**4.1.4.1.2** The two samples collected in accordance with the procedures specified in 4.1.4.1.1.1 or 4.1.4.1.1.2 shall be tested to verify that the specific gravity of both samples is similar and that the solution is in compliance with 8.3.3. The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.

**4.1.4.1.3\*** If concentrations of the two samples collected in accordance with the procedures above are similar and in compliance with 8.3.3, then (a) the solution drained in accordance with 4.1.4.1.1.1 can be used to refill the system, or (b) the existing undrained solution tested in accordance with 4.1.4.1.1.2 shall be permitted to continue to be used. If the two samples are not similar and not in compliance with 8.3.3, then a solution in compliance with 8.3.3 shall be used to refill the system.

**A.4.1.4.1.3** In the past, for some existing systems subject to extremely low temperatures, antifreeze solutions with concentrations greater than what is now permitted by NFPA 13D were used. Such high concentrations of antifreeze are no longer permitted. In situations where extremely low temperatures are anticipated, refilling the fire sprinkler system with a concentration of antifreeze solution currently permitted by the standard might not provide sufficient freeze protection without additional measures. Such measures might include converting the antifreeze system to another type of sprinkler system.

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**4.1.4.1.4** A tag shall be attached to the riser indicating the date the antifreeze solution was tested. The tag shall also indicate the type and concentration of antifreeze solution (by volume) with which the system is filled, the date the antifreeze was replaced (if applicable), the name of the contractor that tested and/or replaced the antifreeze solution, the contractor's license number, a statement indicating if the entire system was drained and replaced with antifreeze, and a warning to test the concentration of the antifreeze solutions at yearly intervals per NFPA 13D.

**6.2\*** **Water Supply Sources.** *When the requirements of Section 6.2.2 are met, the following water supply sources shall be considered to be acceptable by this standard:*

- (1) A connection to a reliable waterworks system with or without an automatically operated pump
- (2) An elevated tank
- (3) A pressure tank designed to American Society of Mechanical Engineers (ASME) standards for a pressure vessel with a reliable pressure source
- (4) A stored water source with an automatically operated pump
- (5) A well with a pump of sufficient capacity and pressure to meet the sprinkler system demand. The stored water requirement of 6.1.2 or 6.1.3 shall be permitted to be a combination of the water in the well (including the refill rate) plus the water in the holding tank if such tank can supply the sprinkler system.

**6.2.2** Where a well, pump, tank or combination thereof is the source of supply for a fire sprinkler system, *the water supply shall serve both domestic and fire sprinkler systems, and the following shall be met:*

- (1) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.
- (2) Any disconnecting means for the pump shall be approved.
- (3) A method for refilling the tank shall be piped to the tank.
- (4) A method of seeing the water level in the tank shall be provided without having to open the tank.
- (5) The pump shall not be permitted to sit directly on the floor.

**6.2.2.1** *Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.*

**6.2.4** *Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler.*

**Add Section 6.6.8 as follows:**

**6.6.8** *Sprinklers shall be permitted to be omitted for following structures:*

- (1) *Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.*
- (2) *Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.*

**Add an asterisk to 8.3.3 and add a new A.8.3.3 to read as follows:**

**8.3.3\* Antifreeze Systems.**

**A.8.3.3** Where protection of pipes from freezing is a concern, options other than antifreeze are available. Such alternatives include running the piping in warm spaces, tenting insulation over pipe, dry-pipe systems, and preaction systems.

**Revise 8.3.3.2.1 to read as follows:**

**8.3.3.2.1\*** Unless permitted by 8.3.3.2.1.1, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5 percent) at a maximum concentration of 50 percent by volume, propylene glycol at a maximum concentration of 40 percent by volume, or other solutions listed specifically for use in fire protection systems.

**Add a new 8.3.3.2.1.1 to read as follows:**

**8.3.3.2.1.1** For existing systems, antifreeze solutions shall be limited to premixed antifreeze solutions of glycerine (chemically pure or United States Pharmacopoeia 96.5 percent) at a maximum concentration of 50 percent by volume, propylene glycol at a maximum concentration of 40 percent by volume, or other solutions listed specifically for use in fire protection systems.

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Delete 8.3.3.2.2 and 8.3.3.2.3 and related Annex material A.8.3.3.2.3.

Move Table 8.3.3.2.3 to the annex and renumber as Table A.8.3.3.2.1 while deleting the rows in the table dealing with glycerine and 40 percent water, glycerine and 30 percent water, propylene glycol and 50 percent water and propylene glycol and 40 percent water. Add an annex note so that the annex and Table would appear as follows:

A.8.3.3.2.1 See Table A.8.3.3.2.1.

TABLE A.8.3.3.2.1 PROPERTIES OF GLYCERINE AND PROPYLENE GLYCOL

MATERIAL	SOLUTION (by volume)	SPECIFIC GRAVITY AT 60°F (15.6°C)	FREEZING POINT	
			°F	°C
Glycerine (C.P. or U.S.P. grade)	50% water	1.145	-20.9	-29.4
Hydrometer scale 1.000 to 1.200				
Propylene glycol	60% water	1.034	-6	-21.1
Hydrometer scale 1.000 to 1.200 (subdivisions 0.002)				

C.P.: Chemically Pure; U.S.P.: United States Pharmacopoeia 96.5%.

Renumber 8.3.3.2.3.1 to 8.3.3.2.2.

8.3.3.2.2 The concentration of antifreeze solutions shall be limited to the minimum necessary for the anticipated minimum temperature.

Delete 8.3.3.2.4, 8.3.3.2.5 and Table 8.3.3.2.5.

Renumber 8.3.3.2.6 as 8.3.3.2.3 and renumber A.8.3.3.2.6 as A.8.3.3.2.3. Also renumber Figure A.8.3.3.2.6 as Figure A.8.3.3.2.3.

8.3.3.2.3\* An antifreeze solution with a freezing point below the expected minimum temperature for the locality shall be installed.

A.8.3.3.2.3 Beyond certain limits, an increased proportion of antifreeze does not lower the freezing point of the solution (see Figure A.8.3.3.2.3). Glycerine, diethylene glycol, ethylene glycol, and propylene glycol never should be used without mixing with water in the proper proportions, because these materials tend to thicken near 32°F (0°C).

Renumber 8.3.3.2.7 as 8.3.3.2.4 and revise to read as follows:

8.3.3.2.4 The specific gravity of the antifreeze shall be checked by a hydrometer with a scale having 0.002 subdivisions in accordance with Figure 8.3.3.2.4(a) and 8.3.3.2.4(b).

Renumber Figure 8.3.3.2.3(a) as Figure 8.3.3.2.4(a) and delete the 50 percent curve.

Renumber Figure 8.3.3.2.3(b) as Figure 8.3.3.2.4(b) and delete the 60 percent and 70 percent curves.

8.6.4\* Sprinklers shall not be required in detached garages, open attached porches, carports with no habitable space above, and similar structures.

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Installation of Sprinkler Systems in Residential Occupancies Up to and

Including Four Stories in Height as amended\* . . . . . 903.3.1.2, 903.3.5.1.1, 903.3.5.1.2, 903.4

\*NFPA 13R, Amended Sections as follows:

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2006 California edition.

Add Section 6.3.5 as follows:

6.3.5 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

- (1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed
- (2) NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* 2006 California Edition and Title 19, *California Code of Regulations*, Chapter 5.
- (3) Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, *California Code of Regulations*, Chapter 5, shall be affixed to each system riser.



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14—13 Installation of Standpipe and Hose System, *as amended*\* . . . . . 905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

**NFPA 14, Amended Sections as follows:**

**Replace Section 6.3.7.1**

**6.3.7.1** System water supply valves, isolation control valves, and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:

(1) Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

- (a) a central station, proprietary, or remote supervising station, or
- (b) a local signaling service that initiates an audible signal at a constantly attended location.

(2) Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

- (a) Locking the valves in the open position, or
- (b) Sealing of valves and a approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

15—12 Water Spray Fixed Systems for Fire Protection

16—07 Installation of Foam-water Sprinkler and Foam-water Spray Systems . . . . . 904.7, 904.11

17—13 Dry Chemical Extinguishing Systems . . . . . 904.6, 904.11

17A—13 Wet Chemical Extinguishing Systems . . . . . 904.5, 904.11

20—13 Installation of Stationary Pumps for Fire Protection . . . . . 913.1, 913.2.1, 913.5

22—13 Water Tanks for Private Fire Protection

24—13 Installation of Private Fire Service Mains and Their Appurtenances, *as amended*\* . . . . .

**NFPA 24, Amended Sections as follows:**

**Amend Section 4.2.1**

**Section 4.2.1.** Installation work shall be done by fully experienced and responsible contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.

**Revise Section 4.2.2 as follows:**

**4.2.2** Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from the authority having jurisdiction.

**Add Section 4.2.2.1 as follows:**

**4.2.2.1** As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.

**Revise Section 5.9.1.2 as follows:**

**Section 5.9.1.2** Fire department connections shall be properly supported and protected from mechanical damage.

**Revise Section 5.9.5.1 as follows:**

**5.9.5.1** Fire department connections shall be on the street side of buildings and as approved by the authority having jurisdiction.

**Revise Section 6.5.1 as follows:**

**6.5.1** Private fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.

**Add Sections 6.5.2.1 – 6.5.2.3**

**6.5.2.1** Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.

**6.5.2.2** Sectional control valves shall be indicating valves in accordance with Section 6.7.1.3.

**6.5.2.3** Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser, and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.

**6.5.2.4** The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.

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*Revise Section 6.6.2 as follows:*

**6.6.2** A sectional valve shall be provided at the following locations:

- (1) On each bank where a main crosses a body of water
- (2) Outside the building foundation(s) where a main or a section of a main runs under a building

*Revise Section 10.6.5 as follows:*

**10.6.5** Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints.*

**Exceptions:**

1. Where allowed in accordance with Section 10.6.2
2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

*Revise Section 10.9.1 as follows:*

**10.9.1** Backfill shall be well tamped in layers or puddle under and around pipes to prevent settlement or lateral movement. Backfill shall consist of clean fill sand or pea gravel to a minimum 6" below and to a minimum of 12" above the pipe and shall contain no ashes, cinders, refuse, organic matter, or other corrosive materials. Other backfill materials and methods are permitted where designed by a registered professional engineer and approved by the enforcing agency.

30—08	Flammable and Combustible Liquids Code	415.3
31—11	Installation of Oil-burning Equipment	2113.15
32—07	Dry Cleaning Plants	415.6.4
37—10	Installation and Use of Stationary Combustion Engines and Gas Turbines	
40—07	Storage and Handling of Cellulose Nitrate Film	409.1
52—13	Compressed Natural Gas (CNG) Vehicular Gaseous Fuel Systems Code	
54—12	National Fuel Gas Code	
58—08	Liquefied Petroleum Gas Code	415.6.3
61—13	Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities	415.6.1
70—08	National Electrical Code	108.3, 415.8.2.8.2, 904.3.1, 907.6.1, 909.12.1, 909.16.3, 1205.4.1, 2701.1, 3401.3, H106.1, H106.2, K101, K111.1
72—13	National Fire Alarm and Signaling Code, as amended*	901.6, 903.4.1, 904.3.5, 907.2, 907.2.5, 907.2.11, 907.2.13.2, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.2, 907.6, 907.6.1, 907.6.5, 907.7, 907.7.1, 907.7.2, 911.1.5, 3006.5, 3007.6

**\*NFPA 72, Amended Sections as follows:**

**10.3.1** Equipment constructed and installed in conformity with this code shall be listed for the purpose for which it is used. *Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

**10.3.3** All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be California State Fire Marshal listed for use with the control unit.

**10.7.1** Where approved by the authority having jurisdiction, ECS priority signals when evaluated by stakeholders through risk analysis in accordance with 24.4.2.2 shall be permitted to take precedence over all other signals.

**14.4.6.1 Testing.** Household fire alarm systems shall be tested in accordance with the manufacturer's published instructions according to the methods of Table 14.4.2.2.

**17.15 Fire Extinguisher Monitoring Device.** A fire extinguisher monitoring device shall indicate those conditions for a specific fire extinguisher required by California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2(c) and California Fire Code to a fire alarm control unit.

**21.3.6** Smoke detectors shall not be installed in unsprinklered elevator hoistways unless they are installed to activate the elevator hoistway smoke relief equipment or where required by Chapter 30 of the California Building Code.

**12.3.7** (4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

**23.8.5.1.2** Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

**Exception:** Fire alarm systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring.

**23.8.5.4.1** Systems equipped with alarm verification features shall be permitted under the following conditions:

- (1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.

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- (2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.6 through 10.13, 23.8.1.1, or 21.2.1 by more than 30 seconds.
- (3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of 4.4.3, 6.8.1.1, or 6.16.2.1 without additional delay.
- (4) The current status of the alarm verification feature is shown on the record of completion (*see Figure 4.5.2.1, item 10*).
- (5) *Operation of a patient room smoke detector in I-2 and R-2.1 Occupancies shall not include an alarm verification feature.*

**29.3.1** All devices, combinations of devices, and equipment to be installed in conformity with this chapter shall be approved and listed by the California State Fire Marshal for the purposes for which they are intended.

**29.5.2.1.1\* Smoke and Heat Alarms.** Unless exempted by applicable laws, codes, or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms, or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.

*Exception to 29.5.2.1.1 not adopted by the SFM.*

**29.7.2.1** *The alarm verification feature shall not be used for household fire warning equipment.*

**29.7.6.7.1** *The alarm verification feature shall not be used for household fire warning equipment.*

**29.8.3.4 Specific Location Requirements.** The installation of smoke alarms and smoke detectors shall comply with the following requirements:

- (1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.
- (2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other spaces where temperatures can fall below 40°F (4°C) or exceed 100°F (38°C).
- (3) Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.
- (4) *Smoke alarms or smoke detectors shall be installed a minimum of 20 feet horizontal distance from a permanently installed cooking appliance.*

*Exception: Ionization smoke alarms with an alarm-silencing switch or photoelectric smoke alarms shall be permitted to be installed 10 feet (3 m) or greater from a permanently installed cooking appliance.*

*Photoelectric smoke alarms shall be permitted to be installed greater than 6 feet (1.8 m) from a permanently installed cooking appliance where the kitchen or cooking area and adjacent spaces have no clear interior partitions and the 10 ft distances would prohibit the placement of a smoke alarm or smoke detector required by other sections of the code.*

*Smoke alarms listed for use in close proximity to a permanently installed cooking appliance.*

- (5) *Installation near bathrooms. Smoke alarms shall be installed not less than a 3 foot (0.91 m) horizontal distance from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by other sections of the code.*
  - (6) Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers.
  - (7) Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan.
  - (8) Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.
  - (9) For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.
  - (10) For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 in. (300 mm) vertically down from the highest point.
  - (11) Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4.
  - (12) Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3.
- |        |  |   |
|--------|--|---|
| 80—13  | Fire Doors and Other Opening Protectives . . . . .   | 410.3.5, 508.2.5.2, 715.4, 715.4.5, 715.4.6, 715.4.7.1, 715.4.8.2, 715.5, 715.5.5, 1008.1.4.3 |
| 85—07  | Boiler and Combustion System Hazards Code . . . . .  | 415.6.1   |
|        | <i>(Note: NFPA 8503 has been incorporated into NFPA 85)</i>                                    |   |
| 92—12  | Standard for Smoke Control Systems . . . . .   | 909.8   |
| 99—05  | Health Care Facilities Code . . . . .  | 407.9   |
| 101—06 | Life Safety Code . . . . .   | 1028.6.2  |
| 105—13 | Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives . . . . . | 405.4.2, 715.4.3.1, 909.20.4.1  |
| 110—13 | Emergency and Standby Power Systems . . . . .  | 2702.1  |

NFPA—continued

111—13	Stored Electrical Energy Emergency and Standby Power Systems . . . . .	2702.1
120—10	<i>Fire Prevention and Control in Coal Mines</i> . . . . .	415.6.1
170—09	<i>Standard for Fire Safety and Emergency Symbols</i> . . . . .	907.1.2
211—13	Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances . . . . .	2112.5
252—03	Standard Methods of Fire Tests of Door Assemblies . . . . .	715.3, 715.4.1, 715.4.2, 715.4.3, 715.4.7.3.1
253—06	Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source . . . . .	402.12.1, 406.6.4, 804.2, 804.3
257—07	Standard for Fire Test for Window and Glass Block Assemblies . . . . .	715.3, 715.4.3.2, 715.5, 715.5.1, 715.5.2, 715.5.9.1
259—13	Test Method for Potential Heat of Building Materials . . . . .	2603.4.1.10, 2603.5.3
265—07	Method of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings on Full Height Panels and Walls . . . . .	803.1.3, 803.1.3.1
268—07	Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source. . . . .	1406.2.1, 1406.2.1.1, 1406.2.1.2, 2603.5.7, D105.1
275—13	Standard Method of Fire Tests for the Evaluation of Thermal Barriers Used Over Foam Plastic Insulation . . . . .	
285—12	Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components . . . . .	1407.10.4, 2603.5.5
286—06	Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth . . . . .	402.16.4, 803.1.2, 803.1.2.1, 803.9, 2603.4, 2603.9
288—12	Standard Method of Fire Tests of <i>Horizontal</i> Fire Door Assemblies Installed in <i>Horizontal</i> Fire-resistance-rated Assemblies. . . . .	712.8
289—13	Standard Method of Fire Test for Individual Fuel Packages . . . . .	
409—11	Aircraft Hangars . . . . .	412.4.6, Table 412.4.6, 412.4.6.1, 412.6.5
418—06	Standard for Heliports . . . . .	412.7.4
484—06	Combustible Metals . . . . .	415.6.1
654—13	Prevention of Fire & Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids. . . . .	415.6.1
655—07	Prevention of Sulfur Fires and Explosions. . . . .	415.6.1
664—07	Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities . . . . .	415.6.1
701—04	Standard Methods of Fire Tests for Flame-propagation of Textiles and Films . . . . .	402.12.1, 410.3.6, 801.1.4, 806.1, 806.1.2, 806.2, 3102.3, 3102.3.1, 3102.6.1.1, 3105.4, D102.2.8, H106.1.1
704—07	Standard System for the Identification of the Hazards of Materials for Emergency Response . . . . .	414.7.2, 415.2
720—12	<i>Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment</i> . . . . .	420.6
1124—13	Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles . . . . .	415.3.1
2001—12	Clean Agent Fire Extinguishing Systems, as amended*. . . . .	Table 901.6.1, 904.10

\*NFPA 2001, Amended Sections as follows:

4.3.5.1.1 Alarms signals from the fire extinguishing system shall not interfere with the building fire alarm signal.

4.3.5.2.1 The lens on visual appliances shall be “red” in color.

Exception: Other lens colors are permitted where approved by the enforcing agency.

PCI

Standard  
reference  
number

Precast Prestressed Concrete Institute  
209 W. Jackson Boulevard, Suite 500  
Chicago, IL 60606-6938

Referenced  
in code  
section number

MNL 124—89	Design for Fire Resistance of Precast Prestressed Concrete. . . . .	721.2.3.1
MNL 128—01	Recommended Practice for Glass Fiber Reinforced Concrete Panels. . . . .	1913.2.1
PCI 120—10	<i>PCI Design Handbook 7th Edition</i> . . . . .	1905A.1

PTI

Standard  
reference  
number

Post-Tensioning Institute  
8601 North Black Canyon Highway, Suite 103  
Phoenix, AZ 85021

Referenced  
in code  
section number

PTI—2004	<i>Recommendations for Prestressed Rock and Soil Anchors (4th Edition)</i> . . . . .	1811A.2, 1810A.3.10.4, J106.2.4, J106.2.5
PTI—2007	Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils, Third Edition . . . . .	1808.6.2
PTI—2007	Standard Requirements for Design of Shallow Post-tensioned Concrete Foundation on Expansive Soils, Second Edition . . . . .	1808.6.2

## REFERENCED STANDARDS

**SFM**  
 State of California  
 Department of Forestry and Fire Protection  
 Office of the State Fire Marshal  
 P.O. Box 944246  
 Sacramento, CA 94246-2460

Standard reference number	Title	Referenced in code section number
12-3	Releasing Systems for Security Bars in Dwellings . . . . .	1029.4
12-7-3	Fire-testing Furnaces . . . . .	NA
12-7A-1	Exterior Wall Siding and Sheathing . . . . .	703A.7, 707A.2
12-7A-2	Exterior Window . . . . .	703A.7, 708A.2.1
12-7A-3	Under Eave . . . . .	703A.7, 707A.8
12-7A-4	Decking . . . . .	703A.7, 709A.3
SFM 12-7A-4A	Decking Alternate Method A . . . . .	703A.7, 709A.3
SFM 12-7A-5	Ignition Resistant Building Material . . . . .	703A.7, 709A.3
12-8-100	Room Fire Tests for Wall and Ceiling Materials . . . . .	NA
12-10-1	Power Operated Exit Doors . . . . .	NA
12-10-2	Single Point Latching or Locking Devices . . . . .	NA
12-10-3	Emergency Exit and Panic Hardware . . . . .	NA
(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.)		

**RMI**  
 Rack Manufacturers Institute  
 8720 Red Oak Boulevard, Suite 201  
 Charlotte, NC 28217

Standard reference number	Title	Referenced in code section number
ANSI/MH16.1—08	Specification for Design, Testing and Utilization of Industrial Steel Storage Racks . . . . .	2208.1

**SDI**  
 Steel Deck Institute  
 P. O. Box 25  
 Fox River Grove, IL 60021

Standard reference number	Title	Referenced in code section number
ANSI/NC1.0—06	Standard for Noncomposite Steel Floor Deck . . . . .	2209.2.2, 2209.2.2.1
ANSI/RD1.0—06	Standard for Steel Roof Deck. . . . .	2209.2.3

**SJI**  
 Steel Joist Institute  
 1173B London Links Drive  
 Forest, VA 24551

Standard reference number	Title	Referenced in code section number
CJ-1.0—06	Standard Specification for Composite Steel Joists, CJ-series . . . . .	1604.3.3, 2203.2, 2206.1
JG-1.1—05	Standard Specification for Joist Girders. . . . .	1604.3.3, 2203.2, 2206.1
K-1.1—05	Standard Specification for Open Web Steel Joists, K-series . . . . .	1604.3.3, 2203.2, 2206.1
LH/DLH-1.1—05	Standard Specification for Longspan Steel Joists, LH-series and Deep Longspan Steel Joists, DLH-series . . . . .	1604.3.3, 2203.2, 2206.1

**SPRI**  
 Single-Ply Roofing Institute  
 411 Waverly Oaks Road, Suite 331B  
 Waltham, MA 02452

Standard reference number	Title	Referenced in code section number
SPRI/ANSI/ES-1—03	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems. . . . .	1504.5
RP-4—02	Wind Design Guide for Ballasted Single-ply Roofing Systems . . . . .	1504.4

# TIA

Telecommunications Industry Association  
2500 Wilson Boulevard  
Arlington, VA 22201-3834

Standard reference number	Title	Referenced in code section number
TIA-222-G—05	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures including-Addendum 1, 222-G-1, Dated 2007 . . . . .	1609.1.1, 3108.1, 3108.2

# TMS

The Masonry Society  
3970 Broadway, Unit 201-D  
Boulder, CO 80304-1135

Standard reference number	Title	Referenced in code section number
0216—97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies . . . . .	Table 720.1(2), 721.1
0302—07	Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls . . . . .	1207.2.1
402—11	Building Code Requirements for Masonry Structures . . . . .	1405.6, 1405.6.2, 1405.10, <i>1410.2.1</i> , 1604.3.4, Table 1703.4.5.3, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, 1807.1.6.3.2, 1808.9, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2109.2.1, 2109.3, 2110.1, <i>2114.10</i> , <i>2114.11</i>
602—08	Specification for Masonry Structures . . . . .	1405.6.1, Table 1704.5.1, Table 1704.5.3, 1807.1.6.3, 2103.8, 2103.11, 2103.12, 2103.13, 2104.1, 2104.1.1, 2104.1.2, 2104.1.3, 2104.2, 2104.3, 2104.4, 2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3

# TPI

Truss Plate Institute  
218 N. Lee Street, Suite 312  
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
TPI 1—2007	National Design Standards for Metal-plate-connected Wood Truss Construction . . . . .	2303.4.6, 2306.1

# UBC

International Code Council, Inc.  
500 New Jersey Avenue, NW 6th Floor  
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
UBC Standard 15-2	Test Standard for Determining the Fire Retardancy of Roof-Covering Materials . . . . .	1505.6
UBC Standard 15-3	Wood Shakes . . . . .	1505.6
UBC Standard 15-4	Wood Shingles . . . . .	1505.6

# UL

Underwriters Laboratories, Inc.  
333 Pfingsten Road  
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
9—2000	Fire Tests of Window Assemblies—with Revisions through April 2005 . . .	715.3, 715.4.3.2, 715.5, 715.5.1, 715.5.2, 715.5.9.1
10A—98	Tin Clad Fire Doors—with Revisions through March 2003 . . . . .	715.4
10B—97	Fire Tests of Door Assemblies—with Revisions through October 2001 . . . . .	715.4.2
10C—98	Positive Pressure Fire Tests of Door Assemblies—with Revisions through November 2001 . . . . .	715.4.1, 715.4.3
13—96	<i>Power-limited Circuit Cables</i>	
14B—98	Sliding Hardware for Standard Horizontally-mounted Tin Clad Fire Doors—with Revisions through July 2000 . . . . .	715.4
14C—06	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs . . . . .	715.4
38—99	<i>Manually Actuated Signaling Boxes—with revisions through February 2, 2005 as amended.*</i>	

## REFERENCED STANDARDS

### UL—continued

#### *\*Amend Section 14.1.5 as follows:*

**14.1.5** A signaling box having a glass panel, disc, rod or similar part that must be broken to operate it for a signal or for access to its actuating means shall satisfactorily complete five part-breaking operations using the means provided with the box, without jamming of the mechanism or other interference by broken particles. It shall be practicable to remove and replace the broken parts. A signaling box shall not have a glass panel, disc, rod or similar part requiring a striking action by grasping a tool to operate it for a signal. The force required to activate controls shall be no greater than 5 pounds (22 N) of force.

#### *\*Add Appendix B chapter to UL 38 (1999) as follows:*

#### **Appendix B,**

**14.1.5 Operation.** Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

103—01	Factory-built Chimneys, for Residential Type and Building Heating Appliances— with Revisions through June 2006 . . . . .	717.2.5.1
127—96	Factory-built Fireplaces—with Revisions through November 2006 . . . . .	717.2.5.1, 2111.11
193—04	Alarm Valves for Fire-Protection Service	
199—95	Automatic Sprinklers for Fire Protection Service—with revisions through August 19, 2005	
199E—04	Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers . . . . .	904.11.4.1
217—06	Single and Multiple Station Smoke Alarms—with Revisions through August 2005 . . . . .	907.2.11
228—97	Door Closers/Holders, with or without Integral Smoke Detectors—with revisions through January 26, 2006	
260—04	Dry Pipe and Deluge Valves for Fire Protection Service	
262—04	Gate Valves for Fire Protection Service	
263—03	Standard for Fire Test of Building Construction and Materials. . . . .	703.2, 703.2.1, 703.2.3, 703.3, 703.5, 704.12, 705.7, 707.7, 712.3.2, 713.3.1, 713.4.1.1, 714.1, 715.2, 716.5.2, 716.5.3, 716.6.1, Table 716.6.2(1), Table 720.1(1), 1407.10.2, 2103.2, 2603.4, 2603.5.1
268—06	Smoke Detectors for Fire Protective Signaling Systems—with Revisions through January 1999 . . . . .	407.7, 907.2.6.2
268A—98	Smoke Detectors for Duct Application—with revisions through October 22, 2003	
300—05	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas . . . . .	904.11
305—07	Panic Hardware . . . . .	1008.1.10
312—04	Check Valves for Fire-Protection Service	
325—02	Door, Drapery, Gate, Louver and Window Operations and Systems— with Revisions through February 2006 . . . . .	406.1.5, 3110.4
346—05	Waterflow Indicators for Fire Protective Signaling Systems	
464—03	Audible Signal Appliances—with revisions through October 10, 2003	
497B—04	Protectors for Data Communication and Fire Alarm Circuits	
521—99	Heat Detectors for Fire Protective Signaling Systems—with Revisions through July 20, 2005	
539—00	Single- and Multiple-Station Heat Detectors—with Revisions through August 15, 2005	
555—2006	Fire Dampers . . . . .	716.3
555C—2006	Ceiling Dampers . . . . .	716.3, 716.6.2
555S—99	Smoke Dampers—with Revisions through July 2006 . . . . .	716.3, 716.3.1.1
580—2006	Test for Uplift Resistance of Roof Assemblies . . . . .	1504.3.1, 1504.3.2
632—00	Electrically Actuated Transmitters	
641—95	Type L Low-temperature Venting Systems—with Revisions through August 2005 . . . . .	2113.11.1.4
710B—04	Recirculating Systems—with Revisions through April 2006 . . . . .	904.11
723—03	Standard for Test for Surface Burning Characteristics of Building Materials— with Revisions through May 2005 . . . . .	402.11, 402.16.4, 406.5.3, 703.4.2, 719.1, 719.4, 802.1, 803.1.1, 803.9, 806.5, 1407.9, 1407.10.1, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4, 3105.4, D102.2.8
753—04	Alarm Accessories for Automatic Water Supply Valves for Fire Protection Service	
790—04	Standard Test Methods for Fire Tests of Roof Coverings . . . . .	1505.1, 2603.6, 2610.2, 2610.3
793—03	Standards for Automatically Operated Roof Vents for Smoke and Heat— with Revisions through April 2004 . . . . .	910.3.1
813—96	Commercial Audio Equipment—with revisions through December 7, 1999	
864—03	Control Units for Fire Protective Signaling Systems, as amended*—with revisions through February 2010 . . . . .	909.12

#### *\*Amend No. 55.1 as follows:*

**RETARD-RESET-RESTART PERIOD – MAXIMUM 30 SECONDS**—No alarm obtained from control unit. Maximum permissible time is 30 seconds.

UL—continued

*\*Amend Section 55.2.2 as follows:*

*Where an alarm verification feature is provided, the maximum retard-reset-restart period before an alarm signal can be confirmed and indicated at the control unit, including any control unit reset time and the power-up time for the detector to become operational for alarm, shall not exceed 30 seconds. (The balance of the section text is to remain unchanged).*

*\*Add Section 55.2.9 as follows:*

*Smoke detectors connected to an alarm verification feature shall not be used as releasing devices.*

**Exception:** *Smoke detectors which operate their releasing function immediately upon alarm actuation independent of alarm verification feature.*

*\*Amend Section 89.1.10 as follows:*

The existing text of this section is to remain as printed with one editorial amendment as follows:

**THE TOTAL DELAY (CONTROL UNIT PLUS SMOKE DETECTORS) SHALL NOT EXCEED 30 SECONDS.**

(The balance of the section text is to remain unchanged).

924—06	Standard for Safety Emergency Lighting and Power Equipment . . . . .	1011.4
1040—96	Fire Test of Insulated Wall Construction—with Revisions through June 2001. . . . .	1407.10.3, 2603.4, 2603.9
1256—02	Fire Test of Roof Deck Construction—with Revisions through January 2007 . . . . .	1508.1, 2603.3, 2603.4.1.5
1479—03	Fire Tests of Through-penetration Firestops—with Revisions through April 2007 . . . . .	702.1, 713.3.1.2, 713.3.2, 713.4.1.1.2
1482—96	Solid-fuel-type Room Heater—with Revisions through November 2006. . . . .	2112.2, 2112.5
1715—97	Fire Test of Interior Finish Material—with Revisions through March 2004. . . . .	1407.10.2, 1407.10.3, 2603.4, 2603.9
1777—04	Chimney Liners . . . . .	2113.11.1, 2113.19
1784—01	Air Leakage Tests of Door Assemblies—with Revisions through December 2004. . . . .	708.14.1, 711.5.2, 715.4.3.1, 715.4.6.1, 715.4.6.3, 3007.4.3
1897—04	Uplift Tests for Roof Covering Systems . . . . .	1504.3.1
1975—06	Fire Test of Foamed Plastics Used for Decorative Purposes . . . . .	402.11, 402.12.1, 402.16.5
1994—04	Standard for Luminous Egress Path Marking Systems—with Revisions through February 2005 . . . . .	411.7, 1024.2.1, 1024.2.3, 1024.2.4, 1024.4
2017—2000	Standards for General-purpose Signaling Devices and Systems— with Revisions through August 2005 . . . . .	3109.4.1.8
2034—2008	Standard for Single- and Multiple-Station Carbon Monoxide Alarms with Revisions through February 2009. . . . .	420.6, 908.7
2075	<i>Gas and Vapor Detectors and Sensors Effective September 1, 2009 . . . . .</i>	<i>420.6</i>
2075—2007	Standard for Gas and Vapor Detectors and Sensors . . . . .	406.6.6.1
2079—04	Tests for Fire Resistance of Building Joint Systems—with Revisions through March 2006. . . . .	702.1, 714.3, 714.6
2200—04	Stationary Engine Generator Assemblies—with Revisions through July 2004 . . . . .	2702.1.1

**ULC**

Underwriters Laboratories of Canada  
7 Underwriters Road  
Toronto, Ontario, Canada M1R3B4

Standard reference number	Title	Referenced in code section number
CAN/ULC S102.2—1988	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies—with 2000 Revisions . . . . .	719.4

**USC**

United States Code  
c/o Superintendent of Documents  
U.S. Government Printing Office  
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
18 USC Part 1, Ch.40	Importation, Manufacture, Distribution and Storage of Explosive Materials. . . . .	307.2



REFERENCED STANDARDS

<div><div>WDMA</div><div>Window and Door Manufacturers Association 1400 East Touhy Avenue #470 Des Plaines, IL 60018</div></div>		
Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/1.S.2/A440—08	Specifications for Windows, Doors and Unit Skylights . . . . .	1715.5.1, 2405.5

<div><div>WRI</div><div>Wire Reinforcement Institute, Inc. 942 Main Street, Suite 300 Hartford, CT 06103</div></div>		
Standard reference number	Title	Referenced in code section number
WRI/CRSI—81	Design of Slab-on-ground Foundations—with 1996 Update. . . . .	1808.6.2

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX A – EMPLOYEE QUALIFICATIONS

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX A

# EMPLOYEE QUALIFICATIONS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION A101 BUILDING OFFICIAL QUALIFICATIONS

**A101.1 Building official.** The building official shall have at least 10 years' experience or equivalent as an architect, engineer, inspector, contractor or superintendent of construction, or any combination of these, five years of which shall have been supervisory experience. The building official should be certified as a building official through a recognized certification program. The building official shall be appointed or hired by the applicable governing authority.

**A101.2 Chief inspector.** The building official can designate supervisors to administer the provisions of the *California Building, Mechanical and Plumbing Codes* and *California Fuel Gas Code*. Each supervisor shall have at least 10 years' experience or equivalent as an architect, engineer, inspector, contractor or superintendent of construction, or any combination of these, five years of which shall have been in a supervisory capacity. They shall be certified through a recognized certification program for the appropriate trade.

**A101.3 Inspector and plans examiner.** The building official shall appoint or hire such number of officers, inspectors, assistants and other employees as shall be authorized by the jurisdiction. A person shall not be appointed or hired as inspector of construction or plans examiner who has not had at least 5 years' experience as a contractor, engineer, architect, or as a superintendent, foreman or competent mechanic in charge of construction. The inspector or plans examiner shall be certified through a recognized certification program for the appropriate trade.

**A101.4 Termination of employment.** Employees in the position of building official, chief inspector or inspector shall not be removed from office except for cause after full opportunity has been given to be heard on specific charges before such applicable governing authority.

### SECTION A102 REFERENCED STANDARDS

IBC—12	California Building Code	A101.2
IMC—12	California Mechanical Code	A101.2
IPC—12	California Plumbing Code	A101.2
IFGC—12	California Fuel Gas Code	A101.2



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX B – BOARD OF APPEALS

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX B

# BOARD OF APPEALS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION B101 GENERAL

**B101.1 Application.** The application for appeal shall be filed on a form obtained from the building official within 20 days after the notice was served.

**B101.2 Membership of board.** The board of appeals shall consist of persons appointed by the chief appointing authority as follows:

1. One for five years; one for four years; one for three years; one for two years; and one for one year.
2. Thereafter, each new member shall serve for five years or until a successor has been appointed.

The building official shall be an ex officio member of said board but shall have no vote on any matter before the board.

**B101.2.1 Alternate members.** The chief appointing authority shall appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership and shall be appointed for five years, or until a successor has been appointed.

**B101.2.2 Qualifications.** The board of appeals shall consist of five individuals, one from each of the following professions or disciplines:

1. Registered design professional with architectural experience or a builder or superintendent of building construction with at least ten years' experience, five of which shall have been in responsible charge of work.
2. Registered design professional with structural engineering experience.
3. Registered design professional with mechanical and plumbing engineering experience or a mechanical contractor with at least ten years' experience, five of which shall have been in responsible charge of work.
4. Registered design professional with electrical engineering experience or an electrical contractor with at least ten years' experience, five of which shall have been in responsible charge of work.
5. Registered design professional with fire protection engineering experience or a fire protection contractor with at least ten years' experience, five of which shall have been in responsible charge of work.

**B101.2.3 Rules and procedures.** The board is authorized to establish policies and procedures necessary to carry out its duties.

**B101.2.4 Chairperson.** The board shall annually select one of its members to serve as chairperson.

**B101.2.5 Disqualification of member.** A member shall not hear an appeal in which that member has a personal, professional or financial interest.

**B101.2.6 Secretary.** The chief administrative officer shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer.

**B101.2.7 Compensation of members.** Compensation of members shall be determined by law.

**B101.3 Notice of meeting.** The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic meetings.

**B101.3.1 Open hearing.** All hearings before the board shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

**B101.3.2 Procedure.** The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be received.

**B101.3.3 Postponed hearing.** When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

**B101.4 Board decision.** The board shall modify or reverse the decision of the building official by a concurring vote of two-thirds of its members.

**B101.4.1 Resolution.** The decision of the board shall be by resolution. Certified copies shall be furnished to the appellant and to the building official.

**B101.4.2 Administration.** The building official shall take immediate action in accordance with the decision of the board.





## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### APPENDIX C – GROUP U – AGRICULTURAL BUILDINGS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>		X																		
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX C

# GROUP U—AGRICULTURAL BUILDINGS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION C101 GENERAL

**C101.1 Scope.** The provisions of this appendix shall apply exclusively to agricultural buildings. Such buildings shall be classified as Group U and shall include the following uses:

1. Livestock shelters or buildings, including shade structures and milking barns.
2. Poultry buildings or shelters.
3. Barns.
4. Storage of equipment and machinery used exclusively in agriculture.
5. Horticultural structures, including detached production greenhouses and crop protection shelters.
6. Sheds.
7. Grain silos.
8. Stables.

### SECTION C102 ALLOWABLE HEIGHT AND AREA

**C102.1 General.** Buildings classified as Group U Agricultural shall not exceed the area or height limits specified in Table C102.1.

**C102.2 One-story unlimited area.** The area of a one-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

**C102.3 Two-story unlimited area.** The area of a two-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width and is provided with an approved automatic sprinkler system throughout in accordance with Section 903.3.1.1.

### SECTION C103 MIXED OCCUPANCIES

**C103.1 Mixed occupancies.** Mixed occupancies shall be protected in accordance with Section 508.

### SECTION C104 EXITS

**C104.1 Exit facilities.** Exits shall be provided in accordance with *Chapters 11A or 11B as applicable*.

#### Exceptions:

1. The maximum travel distance from any point in the building to an approved exit shall not exceed 300 feet (91 440 mm).
2. One exit is required for each 15,000 square feet (1393.5 m<sup>2</sup>) of area or fraction thereof.

**TABLE C102.1**  
**BASIC ALLOWABLE AREA FOR A GROUP U, ONE STORY IN HEIGHT AND MAXIMUM HEIGHT OF SUCH OCCUPANCY**

I		II		III and IV		V	
A	B	A	B	III A and IV	III B	A	B
<b>ALLOWABLE AREA (square feet)<sup>a</sup></b>							
Unlimited	60,000	27,100	18,000	27,100	18,000	21,100	12,000
<b>MAXIMUM HEIGHT IN STORIES</b>							
Unlimited	12	4	2	4	2	3	2
<b>MAXIMUM HEIGHT IN FEET</b>							
Unlimited	160	65	55	65	55	50	40

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

a. See Section C102 for unlimited area under certain conditions.



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX D – FIRE DISTRICTS

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX D

# FIRE DISTRICTS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION D101 GENERAL

**D101.1 Scope.** The fire district shall include such territory or portion as outlined in an ordinance or law entitled "An Ordinance (Resolution) Creating and Establishing a Fire District." Wherever, in such ordinance creating and establishing a fire district, reference is made to the fire district, it shall be construed to mean the fire district designated and referred to in this appendix.

**D101.1.1 Mapping.** The fire district complying with the provisions of Section D101.1 shall be shown on a map that shall be available to the public.

**D101.2 Establishment of area.** For the purpose of this code, the fire district shall include that territory or area as described in Sections D101.2.1 through D101.2.3.

**D101.2.1 Adjoining blocks.** Two or more adjoining blocks, exclusive of intervening streets, where at least 50 percent of the ground area is built upon and more than 50 percent of the built-on area is devoted to hotels and motels of Group R-1; Group B occupancies; theaters, nightclubs, restaurants of Group A-1 and A-2 occupancies; garages, express and freight depots, warehouses and storage buildings used for the storage of finished products (not located with and forming a part of a manufactured or industrial plant); or Group S occupancy. Where the average height of a building is two and one-half stories or more, a block should be considered if the ground area built upon is at least 40 percent.

**D101.2.2 Buffer zone.** Where four contiguous blocks or more comprise a fire district, there shall be a buffer zone of 200 feet (60 960 mm) around the perimeter of such district. Streets, rights-of-way and other open spaces not subject to building construction can be included in the 200-foot (60 960 mm) buffer zone.

**D101.2.3 Developed blocks.** Where blocks adjacent to the fire district have developed to the extent that at least 25 percent of the ground area is built upon and 40 percent or more of the built-on area is devoted to the occupancies specified in Section D101.2.1, they can be considered for inclusion in the fire district, and can form all or a portion of the 200-foot (60 960 mm) buffer zone required in Section D101.2.2.

### SECTION D102 BUILDING RESTRICTIONS

**D102.1 Types of construction permitted.** Within the fire district every building hereafter erected shall be either Type I, II, III or IV, except as permitted in Section D104.

#### D102.2 Other specific requirements.

**D102.2.1 Exterior walls.** Exterior walls of buildings located in the fire district shall comply with the requirements in Table 601 except as required in Section D102.2.6.

**D102.2.2 Group H prohibited.** Group H occupancies shall be prohibited from location within the fire district.

**D102.2.3 Construction type.** Every building shall be constructed as required based on the type of construction indicated in Chapter 6.

**D102.2.4 Roof covering.** Roof covering in the fire district shall conform to the requirements of Class A or B roof coverings as defined in Section 1505.

**D102.2.5 Structural fire rating.** Walls, floors, roofs and their supporting structural members shall be a minimum of 1-hour fire-resistance-rated construction.

#### Exceptions:

1. Buildings of Type IV construction.
2. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Automobile parking structures.
4. Buildings surrounded on all sides by a permanently open space of not less than 30 feet (9144 mm).
5. Partitions complying with Section 603.1, Item 10.

**D102.2.6 Exterior walls.** Exterior load-bearing walls of Type II buildings shall have a fire-resistance rating of 2 hours or more where such walls are located within 30 feet (9144 mm) of a common property line or an assumed property line. Exterior nonload-bearing walls of Type II buildings located within 30 feet (9144 mm) of a common property line or an assumed property line shall have fire-resistance ratings as required by Table 601, but not less than 1 hour. Exterior walls located more than 30 feet (9144 mm) from a common property line or an assumed property line shall comply with Table 601.

**Exception:** In the case of one-story buildings that are 2,000 square feet (186 m<sup>2</sup>) or less in area, exterior walls located more than 15 feet (4572 mm) from a common property line or an assumed property line need only comply with Table 601.

**D102.2.7 Architectural trim.** Architectural trim on buildings located in the fire district shall be constructed of approved noncombustible materials or fire-retardant-treated wood.



**D102.2.8 Permanent canopies.** Permanent canopies are permitted to extend over adjacent open spaces provided all of the following are met:

1. The canopy and its supports shall be of noncombustible material, fire-retardant-treated wood, Type IV construction or of 1-hour fire-resistance-rated construction.

**Exception:** Any textile covering for the canopy shall be flame resistant as determined by tests conducted in accordance with NFPA 701 after both accelerated water leaching and accelerated weathering.

2. Any canopy covering, other than textiles, shall have a flame spread index not greater than 25 when tested in accordance with ASTM E 84 or UL 723 in the form intended for use.
3. The canopy shall have at least one long side open.
4. The maximum horizontal width of the canopy shall not exceed 15 feet (4572 mm).
5. The fire resistance of exterior walls shall not be reduced.

**D102.2.9 Roof structures.** Structures, except aerial supports 12 feet (3658 mm) high or less, flagpoles, water tanks and cooling towers, placed above the roof of any building within the fire district shall be of noncombustible material and shall be supported by construction of noncombustible material.

**D102.2.10 Plastic signs.** The use of plastics complying with Section 2611 for signs is permitted provided the structure of the sign in which the plastic is mounted or installed is noncombustible.

**D102.2.11 Plastic veneer.** Exterior plastic veneer is not permitted in the fire district.

### SECTION D103 CHANGES TO BUILDINGS

**D103.1 Existing buildings within the fire district.** An existing building shall not hereafter be increased in height or area unless it is of a type of construction permitted for new buildings within the fire district or is altered to comply with the requirements for such type of construction. Nor shall any existing building be hereafter extended on any side, nor square footage or floors added within the existing building unless such modifications are of a type of construction permitted for new buildings within the fire district.

**D103.2 Other alterations.** Nothing in Section D103.1 shall prohibit other alterations within the fire district provided there is no change of occupancy that is otherwise prohibited and the fire hazard is not increased by such alteration.

**D103.3 Moving buildings.** Buildings shall not hereafter be moved into the fire district or to another lot in the fire district

unless the building is of a type of construction permitted in the fire district.

### SECTION D104 BUILDINGS LOCATED PARTIALLY IN THE FIRE DISTRICT

**D104.1 General.** Any building located partially in the fire district shall be of a type of construction required for the fire district, unless the major portion of such building lies outside of the fire district and no part is more than 10 feet (3048 mm) inside the boundaries of the fire district.

### SECTION D105 EXCEPTIONS TO RESTRICTIONS IN FIRE DISTRICT

**D105.1 General.** The preceding provisions of this appendix shall not apply in the following instances:

1. Temporary buildings used in connection with duly authorized construction.
2. A private garage used exclusively as such, not more than one story in height, nor more than 650 square feet (60 m<sup>2</sup>) in area, located on the same lot with a dwelling.
3. Fences not over 8 feet (2438 mm) high.
4. Coal tipples, material bins and trestles of Type IV construction.
5. Water tanks and cooling towers conforming to Sections 1509.3 and 1509.4.
6. Greenhouses less than 15 feet (4572 mm) high.
7. Porches on dwellings not over one story in height, and not over 10 feet (3048 mm) wide from the face of the building, provided such porch does not come within 5 feet (1524 mm) of any property line.
8. Sheds open on a long side not over 15 feet (4572 mm) high and 500 square feet (46 m<sup>2</sup>) in area.
9. One- and two-family dwellings where of a type of construction not permitted in the fire district can be extended 25 percent of the floor area existing at the time of inclusion in the fire district by any type of construction permitted by this code.
10. Wood decks less than 600 square feet (56 m<sup>2</sup>) where constructed of 2-inch (51 mm) nominal wood, pressure treated for exterior use.
11. Wood veneers on exterior walls conforming to Section 1405.5.
12. Exterior plastic veneer complying with Section 2605.2 where installed on exterior walls required to have a fire-resistance rating not less than 1 hour, provided the exterior plastic veneer does not exhibit sustained flaming as defined in NFPA 268.

**SECTION D106**  
**REFERENCED STANDARDS**

ASTM E 84—04	Test Method for Surface Burning Characteristics of Building Materials	D102.2.8
NFPA 268—01	Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source	D105.1
NFPA 701—99	Methods of Fire Tests for Flame-Propagation of Textiles and Films	D102.2.8
UL 723—03	Standard for Test for Surface Burning Characteristics of Building Materials, with Revisions through May 2005	D102.2.8



## **APPENDIX E RESERVED**



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX F – RODENTPROOFING

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX F

# RODENTPROOFING

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION F101 GENERAL

**F101.1 General.** Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or food-stuffs are stored, prepared, processed, served or sold, shall be constructed in accordance with the provisions of this section.

**F101.2 Foundation wall ventilation openings.** Foundation wall ventilator openings shall be covered for their height and width with perforated sheet metal plates no less than 0.070 inch (1.8 mm) thick, expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick, cast-iron grills or grating, extruded aluminum load-bearing vents or with hardware cloth of 0.035 inch (0.89 mm) wire or heavier. The openings therein shall not exceed  $\frac{1}{4}$  inch (6.4 mm).

**F101.3 Foundation and exterior wall sealing.** Annular spaces around pipes, electric cables, conduits, or other openings in the walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or noncorrosive metal.

**F101.4 Doors.** Doors on which metal protection has been applied shall be hinged so as to be free swinging. When closed, the maximum clearance between any door, door jambs and sills shall not be greater than  $\frac{3}{8}$  inch (9.5 mm).

**F101.5 Windows and other openings.** Windows and other openings for the purpose of light or ventilation located in exterior walls within 2 feet (610 mm) above the existing ground level immediately below such opening shall be covered for their entire height and width, including frame, with hardware cloth of at least 0.035-inch (0.89 mm) wire or heavier.

**F101.5.1 Rodent-accessible openings.** Windows and other openings for the purpose of light and ventilation in the exterior walls not covered in this chapter, accessible to rodents by way of exposed pipes, wires, conduits and other appurtenances, shall be covered with wire cloth of at least 0.035-inch (0.89 mm) wire. In lieu of wire cloth covering, said pipes, wires, conduits and other appurtenances shall be blocked from rodent usage by installing solid sheet metal guards 0.024 inch (0.61 mm) thick or heavier. Guards shall be fitted around pipes, wires, conduits or other appurtenances. In addition, they shall be fastened securely to and shall extend perpendicularly from the exterior wall for a minimum distance of 12 inches (305 mm) beyond and on either side of pipes, wires, conduits or appurtenances.

### F101.6 Pier and wood construction.

**F101.6.1 Sill less than 12 inches above ground.** Buildings not provided with a continuous foundation shall be provided with protection against rodents at grade by providing either an apron in accordance with Section F101.6.1.1 or a floor slab in accordance with Section F101.6.1.2.

**F101.6.1.1 Apron.** Where an apron is provided, the apron shall not be less than 8 inches (203 mm) above, nor less than 24 inches (610 mm) below, grade. The apron shall not terminate below the lower edge of the siding material. The apron shall be constructed of an approved nondecayable, water-resistant rodentproofing material of required strength and shall be installed around the entire perimeter of the building. Where constructed of masonry or concrete materials, the apron shall not be less than 4 inches (102 mm) in thickness.

**F101.6.1.2 Grade floors.** Where continuous concrete grade floor slabs are provided, open spaces shall not be left between the slab and walls, and openings in the slab shall be protected.

**F101.6.2 Sill at or above 12 inches above ground.** Buildings not provided with a continuous foundation and which have sills 12 or more inches (305 mm) above the ground level shall be provided with protection against rodents at grade in accordance with any of the following:

1. Section F101.6.1.1 or F101.6.1.2;
2. By installing solid sheet metal collars at least 0.024 inch (0.6 mm) thick at the top of each pier or pile and around each pipe, cable, conduit, wire or other item which provides a continuous pathway from the ground to the floor; or
3. By encasing the pipes, cables, conduits or wires in an enclosure constructed in accordance with Section F101.6.1.1.





# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX G – FLOOD RESISTANT CONSTRUCTION

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX G

# FLOOD-RESISTANT CONSTRUCTION

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION G101 ADMINISTRATION

**G101.1 Purpose.** The purpose of this appendix is to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific flood hazard areas through the establishment of comprehensive regulations for management of flood hazard areas designed to:

1. Prevent unnecessary disruption of commerce, access and public service during times of flooding;
2. Manage the alteration of natural flood plains, stream channels and shorelines;
3. Manage filling, grading, dredging and other development which may increase flood damage or erosion potential;
4. Prevent or regulate the construction of flood barriers which will divert floodwaters or which can increase flood hazards; and
5. Contribute to improved construction techniques in the flood plain.

**G101.2 Objectives.** The objectives of this appendix are to protect human life, minimize the expenditure of public money for flood control projects, minimize the need for rescue and relief efforts associated with flooding, minimize prolonged business interruption, minimize damage to public facilities and utilities, help maintain a stable tax base by providing for the sound use and development of flood-prone areas, contribute to improved construction techniques in the flood plain and ensure that potential owners and occupants are notified that property is within flood hazard areas.

**G101.3 Scope.** The provisions of this appendix shall apply to all proposed development in a flood hazard area established in Section 1612 of this code, including certain building work exempt from permit under Section 105.2.

**G101.4 Violations.** Any violation of a provision of this appendix, or failure to comply with a permit or variance issued pursuant to this appendix or any requirement of this appendix, shall be handled in accordance with Section 114.

### SECTION G102 APPLICABILITY

**G102.1 General.** This appendix, in conjunction with the *California Building Code*, provides minimum requirements for development located in flood hazard areas, including the subdivision of land; installation of utilities; placement and replacement of manufactured homes; new construction and repair, reconstruction, rehabilitation or additions to new con-

struction; substantial improvement of existing buildings and structures, including restoration after damage, temporary structures, and temporary or permanent storage, utility and miscellaneous Group U buildings and structures, and certain building work exempt from permit under Section 105.2.

**G102.2 Establishment of flood hazard areas.** Flood hazard areas are established in Section 1612.3 of the *California Building Code*, adopted by the applicable governing authority on [INSERT DATE].

### SECTION G103 POWERS AND DUTIES

**G103.1 Permit applications.** The building official shall review all permit applications to determine whether proposed development sites will be reasonably safe from flooding. If a proposed development site is in a flood hazard area, all site development activities (including grading, filling, utility installation and drainage modification), all new construction and substantial improvements (including the placement of prefabricated buildings and manufactured homes) and certain building work exempt from permit under Section 105.2 shall be designed and constructed with methods, practices and materials that minimize flood damage and that are in accordance with this code and ASCE 24.

**G103.2 Other permits.** It shall be the responsibility of the building official to assure that approval of a proposed development shall not be given until proof that necessary permits have been granted by federal or state agencies having jurisdiction over such development.

**G103.3 Determination of design flood elevations.** If design flood elevations are not specified, the building official is authorized to require the applicant to:

1. Obtain, review and reasonably utilize data available from a federal, state or other source, or
2. Determine the design flood elevation in accordance with accepted hydrologic and hydraulic engineering techniques. Such analyses shall be performed and sealed by a registered design professional. Studies, analyses and computations shall be submitted in sufficient detail to allow review and approval by the building official. The accuracy of data submitted for such determination shall be the responsibility of the applicant.

**G103.4 Activities in riverine flood hazard areas.** In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the building official shall not permit any new construction, substantial improvement or other development, including fill, unless the

applicant demonstrates that the cumulative effect of the proposed development, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the community.

**G103.5 Floodway encroachment.** Prior to issuing a permit for any floodway encroachment, including fill, new construction, substantial improvements and other development or land-disturbing activity, the building official shall require submission of a certification, along with supporting technical data, that demonstrates that such development will not cause any increase of the level of the base flood.

**G103.5.1 Floodway revisions.** A floodway encroachment that increases the level of the base flood is authorized if the applicant has applied for a conditional Flood Insurance Rate Map (FIRM) revision and has received the approval of the Federal Emergency Management Agency (FEMA).

**G103.6 Watercourse alteration.** Prior to issuing a permit for any alteration or relocation of any watercourse, the building official shall require the applicant to provide notification of the proposal to the appropriate authorities of all affected adjacent government jurisdictions, as well as appropriate state agencies. A copy of the notification shall be maintained in the permit records and submitted to FEMA.

**G103.6.1 Engineering analysis.** The building official shall require submission of an engineering analysis which demonstrates that the flood-carrying capacity of the altered or relocated portion of the watercourse will not be decreased. Such watercourses shall be maintained in a manner which preserves the channel's flood-carrying capacity.

**G103.7 Alterations in coastal areas.** Prior to issuing a permit for any alteration of sand dunes and mangrove stands in flood hazard areas subject to high velocity wave action, the building official shall require submission of an engineering analysis which demonstrates that the proposed alteration will not increase the potential for flood damage.

**G103.8 Records.** The building official shall maintain a permanent record of all permits issued in flood hazard areas, including copies of inspection reports and certifications required in Section 1612.

## SECTION G104 PERMITS

**G104.1 Required.** Any person, owner or authorized agent who intends to conduct any development in a flood hazard area shall first make application to the building official and shall obtain the required permit.

**G104.2 Application for permit.** The applicant shall file an application in writing on a form furnished by the building official. Such application shall:

1. Identify and describe the development to be covered by the permit.

2. Describe the land on which the proposed development is to be conducted by legal description, street address or similar description that will readily identify and definitely locate the site.
3. Include a site plan showing the delineation of flood hazard areas, floodway boundaries, flood zones, design flood elevations, ground elevations, proposed fill and excavation and drainage patterns and facilities.
4. Indicate the use and occupancy for which the proposed development is intended.
5. Be accompanied by construction documents, grading and filling plans and other information deemed appropriate by the building official.
6. State the valuation of the proposed work.
7. Be signed by the applicant or the applicant's authorized agent.

**G104.3 Validity of permit.** The issuance of a permit under this appendix shall not be construed to be a permit for, or approval of, any violation of this appendix or any other ordinance of the jurisdiction. The issuance of a permit based on submitted documents and information shall not prevent the building official from requiring the correction of errors. The building official is authorized to prevent occupancy or use of a structure or site which is in violation of this appendix or other ordinances of this jurisdiction.

**G104.4 Expiration.** A permit shall become invalid if the proposed development is not commenced within 180 days after its issuance, or if the work authorized is suspended or abandoned for a period of 180 days after the work commences. Extensions shall be requested in writing and justifiable cause demonstrated. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each.

**G104.5 Suspension or revocation.** The building official is authorized to suspend or revoke a permit issued under this appendix wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or code of this jurisdiction.

## SECTION G105 VARIANCES

**G105.1 General.** The board of appeals established pursuant to Section 112 shall hear and decide requests for variances. The board of appeals shall base its determination on technical justifications, and has the right to attach such conditions to variances as it deems necessary to further the purposes and objectives of this appendix and Section 1612.

**G105.2 Records.** The building official shall maintain a permanent record of all variance actions, including justification for their issuance.

**G105.3 Historic structures.** A variance is authorized to be issued for the repair or rehabilitation of a historic structure

upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure, and the variance is the minimum necessary to preserve the historic character and design of the structure.

**Exception:** Within flood hazard areas, historic structures that are not:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places; or
2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district; or
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

**G105.4 Functionally dependent facilities.** A variance is authorized to be issued for the construction or substantial improvement of a functionally dependent facility provided the criteria in Section 1612.1 are met and the variance is the minimum necessary to allow the construction or substantial improvement, and that all due consideration has been given to methods and materials that minimize flood damages during the design flood and create no additional threats to public safety.

**G105.5 Restrictions.** The board of appeals shall not issue a variance for any proposed development in a floodway if any increase in flood levels would result during the base flood discharge.

**G105.6 Considerations.** In reviewing applications for variances, the board of appeals shall consider all technical evaluations, all relevant factors, all other portions of this appendix and the following:

1. The danger that materials and debris may be swept onto other lands resulting in further injury or damage;
2. The danger to life and property due to flooding or erosion damage;
3. The susceptibility of the proposed development, including contents, to flood damage and the effect of such damage on current and future owners;
4. The importance of the services provided by the proposed development to the community;
5. The availability of alternate locations for the proposed development that are not subject to flooding or erosion;
6. The compatibility of the proposed development with existing and anticipated development;
7. The relationship of the proposed development to the comprehensive plan and flood plain management program for that area;
8. The safety of access to the property in times of flood for ordinary and emergency vehicles;
9. The expected heights, velocity, duration, rate of rise and debris and sediment transport of the floodwaters

and the effects of wave action, if applicable, expected at the site; and

10. The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, streets and bridges.

**G105.7 Conditions for issuance.** Variances shall only be issued by the board of appeals upon:

1. A technical showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site renders the elevation standards inappropriate;
2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable;
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, nor create nuisances, cause fraud on or victimization of the public or conflict with existing local laws or ordinances;
4. A determination that the variance is the minimum necessary, considering the flood hazard, to afford relief; and
5. Notification to the applicant in writing over the signature of the building official that the issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance up to amounts as high as \$25 for \$100 of insurance coverage, and that such construction below the base flood level increases risks to life and property.

## SECTION G201 DEFINITIONS

**G201.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *California Building Code* for general definitions.

### **G201.2 Definitions.**

**DEVELOPMENT.** Any manmade change to improved or unimproved real estate, including but not limited to, buildings or other structures, temporary structures, temporary or permanent storage of materials, mining, dredging, filling, grading, paving, excavations, operations and other land-disturbing activities.

**FUNCTIONALLY DEPENDENT FACILITY.** A facility which cannot be used for its intended purpose unless it is located or carried out in close proximity to water, such as a docking or port facility necessary for the loading or unloading of cargo or passengers, shipbuilding or ship repair. The term does not include long-term storage, manufacture, sales or service facilities.

**MANUFACTURED HOME.** A structure that is transportable in one or more sections, built on a permanent chassis, designed for use with or without a permanent foundation when attached to the required utilities, and constructed to the

Federal Mobile Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development. The term also includes mobile homes, park trailers, travel trailers and similar transportable structures that are placed on a site for 180 consecutive days or longer.

**MANUFACTURED HOME PARK OR SUBDIVISION.** A parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

**RECREATIONAL VEHICLE.** A vehicle that is built on a single chassis, 400 square feet (37.16 m<sup>2</sup>) or less when measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light-duty truck, and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel or seasonal use. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect-type utilities and security devices and has no permanently attached additions.

**VARIANCE.** A grant of relief from the requirements of this section which permits construction in a manner otherwise prohibited by this section where specific enforcement would result in unnecessary hardship.

**VIOLATION.** A development that is not fully compliant with this appendix or Section 1612, as applicable.

### SECTION G301 SUBDIVISIONS

**G301.1 General.** Any subdivision proposal, including proposals for manufactured home parks and subdivisions, or other proposed new development in a flood hazard area shall be reviewed to assure that:

1. All such proposals are consistent with the need to minimize flood damage;
2. All public utilities and facilities, such as sewer, gas, electric and water systems are located and constructed to minimize or eliminate flood damage; and
3. Adequate drainage is provided to reduce exposure to flood hazards.

**G301.2 Subdivision requirements.** The following requirements shall apply in the case of any proposed subdivision, including proposals for manufactured home parks and subdivisions, any portion of which lies within a flood hazard area:

1. The flood hazard area, including floodways and areas subject to high velocity wave action, as appropriate, shall be delineated on tentative and final subdivision plats;
2. Design flood elevations shall be shown on tentative and final subdivision plats;
3. Residential building lots shall be provided with adequate buildable area outside the floodway; and
4. The design criteria for utilities and facilities set forth in this appendix and appropriate *California Codes* shall be met.

### SECTION G401 SITE IMPROVEMENT

**G401.1 Development in floodways.** Development or land disturbing activity shall not be authorized in the floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment will not result in any increase in the level of the base flood.

**G401.2 Flood hazard areas subject to high-velocity wave action.** In flood hazard areas subject to high-velocity wave action:

1. New buildings and buildings that are substantially improved shall only be authorized landward of the reach of mean high tide.
2. The use of fill for structural support of buildings is prohibited.

**G401.3 Sewer facilities.** All new or replaced sanitary sewer facilities, private sewage treatment plants (including all pumping stations and collector systems) and on-site waste disposal systems shall be designed in accordance with Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the facilities and discharge from the facilities into floodwaters, or impairment of the facilities and systems.

**G401.4 Water facilities.** All new or replacement water facilities shall be designed in accordance with the provisions of Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the systems.

**G401.5 Storm drainage.** Storm drainage shall be designed to convey the flow of surface waters to minimize or eliminate damage to persons or property.

**G401.6 Streets and sidewalks.** Streets and sidewalks shall be designed to minimize potential for increasing or aggravating flood levels.

### SECTION G501 MANUFACTURED HOMES

**G501.1 Elevation.** All new and replacement manufactured homes to be placed or substantially improved in a flood hazard area shall be elevated such that the lowest floor of the manufactured home is elevated to or above the design flood elevation.

**G501.2 Foundations.** All new and replacement manufactured homes, including substantial improvement of existing manufactured homes, shall be placed on a permanent, reinforced foundation that is designed in accordance with Section 1612.

**G501.3 Anchoring.** All new and replacement manufactured homes to be placed or substantially improved in a flood hazard area shall be installed using methods and practices which minimize flood damage. Manufactured homes shall be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement. Methods of anchoring are authorized to include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

### SECTION G601 RECREATIONAL VEHICLES

**G601.1 Placement prohibited.** The placement of recreational vehicles shall not be authorized in flood hazard areas subject to high-velocity wave action and in floodways.

**G601.2 Temporary placement.** Recreational vehicles in flood hazard areas shall be fully licensed and ready for highway use, and shall be placed on a site for less than 180 consecutive days.

**G601.3 Permanent placement.** Recreational vehicles that are not fully licensed and ready for highway use, or that are to be placed on a site for more than 180 consecutive days, shall meet the requirements of Section G501 for manufactured homes.

### SECTION G701 TANKS

**G701.1 Underground tanks.** Underground tanks in flood hazard areas shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood.

**G701.2 Above-ground tanks.** Above-ground tanks in flood hazard areas shall be elevated to or above the design flood elevation or shall be anchored or otherwise designed and constructed to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the design flood.

**G701.3 Tank inlets and vents.** In flood hazard areas, tank inlets, fill openings, outlets and vents shall be:

1. At or above the design flood elevation or fitted with covers designed to prevent the inflow of floodwater or outflow of the contents of the tanks during conditions of the design flood.
2. Anchored to prevent lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the design flood.

### SECTION G801 OTHER BUILDING WORK

**G801.1 Detached accessory structures.** Detached accessory structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood. Fully enclosed accessory structures shall have flood openings to allow for the automatic entry and exit of flood waters.

**G801.2 Fences.** Fences in floodways that may block the passage of floodwaters, such as stockade fences and wire mesh fences, shall meet the requirement of Section G103.5.

**G801.3 Oil derricks.** Oil derricks located in flood hazard areas shall be designed in conformance with the flood loads in Sections 1603.1.7 and 1612.

**G801.4 Retaining walls, sidewalks and driveways.** Retaining walls, sidewalks and driveways shall meet the requirements of Section 1803.4.

**G801.5 Prefabricated swimming pools.** Prefabricated swimming pools in floodways shall meet the requirements of Section G103.5.

### SECTION G901 TEMPORARY STRUCTURES AND TEMPORARY STORAGE

**G901.1 Temporary structures.** Temporary structures shall be erected for a period of less than 180 days. Temporary structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood. Fully enclosed temporary structures shall have flood openings to allow for the automatic entry and exit of floodwaters.

**G901.2 Temporary storage.** Temporary storage includes storage of goods and materials for a period of less than 180 days. Stored materials shall not include hazardous materials.

**G901.3 Floodway encroachment.** Temporary structures and temporary storage in floodways shall meet the requirements of G103.5.

### SECTION G1001 UTILITY AND MISCELLANEOUS GROUP U

**G1001.1 Utility and miscellaneous Group U.** Utility and miscellaneous Group U includes buildings that are accessory in character and miscellaneous structures not classified in any specific occupancy in the *California Building Code*, including, but not limited to, agricultural buildings, aircraft hangars (accessory to a one- or two-family residence), barns, carports, fences more than 6 feet (1829 mm) high, grain silos (accessory to a residential occupancy), greenhouses, livestock shelters, private garages, retaining walls, sheds, stables and towers.

**G1001.2 Flood loads.** Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be anchored to prevent flotation, collapse or lateral movement resulting from flood loads, including the effects of buoyancy, during conditions of the design flood.

**G1001.3 Elevation.** Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be elevated such that the lowest floor, including basement, is elevated to or above the design flood elevation in accordance with Section 1612 of the *California Building Code*.

**G1001.4 Enclosures below design flood elevation.** Fully enclosed areas below the design flood elevation shall be at or above grade on all sides and conform to the following:

1. In flood hazard areas not subject to high-velocity wave action, enclosed areas shall have flood openings to



allow for the automatic inflow and outflow of floodwaters.

2. In flood hazard areas subject to high-velocity wave action, enclosed areas shall have walls below the design flood elevation that are designed to break away or collapse from a water load less than that which would occur during the design flood, without causing collapse, displacement or other structural damage to the building or structure.

**G1001.5 Flood-damage-resistant materials.** Flood-damage-resistant materials shall be used below the design flood elevation.

**G1001.6 Protection of mechanical, plumbing and electrical systems.** Mechanical, plumbing and electrical systems, including plumbing fixtures, shall be elevated to or above the design flood elevation.

**Exception:** Electrical systems, equipment and components, and heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems and other service equipment shall be permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of this code. Electrical wiring systems shall be permitted to be located below the design flood elevation provided they conform to the provisions of NFPA 70.

#### SECTION G1101 REFERENCED STANDARDS

ASCE 24—05	Flood Resistance Design and Construction	G103.1, G401.3, G401.4
HUD 24 CFR Part 3280 (1994)	Manufactured Home Construction and Safety Standards	G201
IBC—12	California Building Code	G102.2
NFPA 70—08	National Electrical Code	G1001.6

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX H – SIGNS

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				



## APPENDIX H

# SIGNS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION H101 GENERAL

**H101.1 General.** A sign shall not be erected in a manner that would confuse or obstruct the view of or interfere with exit signs required by Chapter 10 or with official traffic signs, signals or devices. Signs and sign support structures, together with their supports, braces, guys and anchors, shall be kept in repair and in proper state of preservation. The display surfaces of signs shall be kept neatly painted or posted at all times.

**H101.2 Signs exempt from permits.** The following signs are exempt from the requirements to obtain a permit before erection:

1. Painted nonilluminated signs.
2. Temporary signs announcing the sale or rent of property.
3. Signs erected by transportation authorities.
4. Projecting signs not exceeding 2.5 square feet (0.23 m<sup>2</sup>).
5. The changing of moveable parts of an approved sign that is designed for such changes, or the repainting or repositioning of display matter shall not be deemed an alteration.

### SECTION H102 DEFINITIONS

**H102.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *California Building Code* for general definitions.

**COMBINATION SIGN.** A sign incorporating any combination of the features of pole, projecting and roof signs.

**DISPLAY SIGN.** The area made available by the sign structure for the purpose of displaying the advertising message.

**ELECTRIC SIGN.** A sign containing electrical wiring, but not including signs illuminated by an exterior light source.

**GROUND SIGN.** A billboard or similar type of sign which is supported by one or more uprights, poles or braces in or upon the ground other than a combination sign or pole sign, as defined by this code.

**POLE SIGN.** A sign wholly supported by a sign structure in the ground.

**PORTABLE DISPLAY SURFACE.** A display surface temporarily fixed to a standardized advertising structure which is

regularly moved from structure to structure at periodic intervals.

**PROJECTING SIGN.** A sign other than a wall sign, which projects from and is supported by a wall of a building or structure.

**ROOF SIGN.** A sign erected upon or above a roof or parapet of a building or structure.

**SIGN.** Any letter, figure, character, mark, plane, point, marquee sign, design, poster, pictorial, picture, stroke, stripe, line, trademark, reading matter or illuminated service, which shall be constructed, placed, attached, painted, erected, fastened or manufactured in any manner whatsoever, so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, whatsoever, which is displayed in any manner outdoors. Every sign shall be classified and conform to the requirements of that classification as set forth in this chapter.

**SIGN STRUCTURE.** Any structure which supports or is capable of supporting a sign as defined in this code. A sign structure is permitted to be a single pole and is not required to be an integral part of the building.

**WALL SIGN.** Any sign attached to or erected against the wall of a building or structure, with the exposed face of the sign in a plane parallel to the plane of said wall.

### SECTION H103 LOCATION

**H103.1 Location restrictions.** Signs shall not be erected, constructed or maintained so as to obstruct any fire escape or any window or door or opening used as a means of egress or so as to prevent free passage from one part of a roof to any other part thereof. A sign shall not be attached in any form, shape or manner to a fire escape, nor be placed in such manner as to interfere with any opening required for ventilation.

### SECTION H104 IDENTIFICATION

**H104.1 Identification.** Every outdoor advertising display sign hereafter erected, constructed or maintained, for which a permit is required shall be plainly marked with the name of the person, firm or corporation erecting and maintaining such sign and shall have affixed on the front thereof the permit number issued for said sign or other method of identification approved by the building official.

## SECTION H105 DESIGN AND CONSTRUCTION

**H105.1 General requirements.** Signs shall be designed and constructed to comply with the provisions of this code for use of materials, loads and stresses.

**H105.2 Permits, drawings and specifications.** Where a permit is required, as provided in Chapter 1, construction documents shall be required. These documents shall show the dimensions, material and required details of construction, including loads, stresses and anchors.

**H105.3 Wind load.** Signs shall be designed and constructed to withstand wind pressure as provided for in Chapter 16.

**H105.4 Seismic load.** Signs designed to withstand wind pressures shall be considered capable of withstanding earthquake loads, except as provided for in Chapter 16.

**H105.5 Working stresses.** In outdoor advertising display signs, the allowable working stresses shall conform to the requirements of Chapter 16. The working stresses of wire rope and its fastenings shall not exceed 25 percent of the ultimate strength of the rope or fasteners.

### Exceptions:

1. The allowable working stresses for steel and wood shall be in accordance with the provisions of Chapters 22 and 23.
2. The working strength of chains, cables, guys or steel rods shall not exceed one-fifth of the ultimate strength of such chains, cables, guys or steel.

**H105.6 Attachment.** Signs attached to masonry, concrete or steel shall be safely and securely fastened by means of metal anchors, bolts or approved expansion screws of sufficient size and anchorage to safely support the loads applied.

## SECTION H106 ELECTRICAL

**H106.1 Illumination.** A sign shall not be illuminated by other than electrical means, and electrical devices and wiring shall be installed in accordance with the requirements of NFPA 70. Any open spark or flame shall not be used for display purposes unless specifically approved.

**H106.1.1 Internally illuminated signs.** Except as provided for in Sections 402.16 and 2611, where internally illuminated signs have facings of wood or approved plastic, the area of such facing section shall not be more than 120 square feet ( $11.16 \text{ m}^2$ ) and the wiring for electric lighting shall be entirely enclosed in the sign cabinet with a clearance of not less than 2 inches (51 mm) from the facing material. The dimensional limitation of 120 square feet ( $11.16 \text{ m}^2$ ) shall not apply to sign facing sections made from flame-resistant-coated fabric (ordinarily known as "flexible sign face plastic") that weighs less than 20 ounces per square yard (678 g/m<sup>2</sup>) and that, when tested in accordance with NFPA 701, meets the fire propagation performance requirements of both Test 1 and Test 2 or that when tested in accordance with an approved test method, exhibits an average burn time of 2 seconds or less and a

burning extent of 5.9 inches (150 mm) or less for 10 specimens.

**H106.2 Electrical service.** Signs that require electrical service shall comply with NFPA 70.

## SECTION H107 COMBUSTIBLE MATERIALS

**H107.1 Use of combustibles.** Wood, approved plastic or plastic veneer panels as provided for in Chapter 26, or other materials of combustible characteristics similar to wood, used for moldings, cappings, nailing blocks, letters and laticing, shall comply with Section H109.1, and shall not be used for other ornamental features of signs, unless approved.

**H107.1.1 Plastic materials.** Notwithstanding any other provisions of this code, plastic materials which burn at a rate no faster than 2.5 inches per minute (64 mm/s) when tested in accordance with ASTM D 635 shall be deemed approved plastics and can be used as the display surface material and for the letters, decorations and facings on signs and outdoor display structures.

**H107.1.2 Electric sign faces.** Individual plastic facings of electric signs shall not exceed 200 square feet ( $18.6 \text{ m}^2$ ) in area.

**H107.1.3 Area limitation.** If the area of a display surface exceeds 200 square feet ( $18.6 \text{ m}^2$ ), the area occupied or covered by approved plastics shall be limited to 200 square feet ( $18.6 \text{ m}^2$ ) plus 50 percent of the difference between 200 square feet ( $18.6 \text{ m}^2$ ) and the area of display surface. The area of plastic on a display surface shall not in any case exceed 1,100 square feet ( $102 \text{ m}^2$ ).

**H107.1.4 Plastic appurtenances.** Letters and decorations mounted on an approved plastic facing or display surface can be made of approved plastics.

## SECTION H108 ANIMATED DEVICES

**H108.1 Fail-safe device.** Signs that contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than 15 inches (381 mm). The fail-safe device shall be in addition to the mechanism and the mechanism's housing which operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

## SECTION H109 GROUND SIGNS

**H109.1 Height restrictions.** The structural frame of ground signs shall not be erected of combustible materials to a height of more than 35 feet (10668 mm) above the ground. Ground signs constructed entirely of noncombustible material shall not be erected to a height of greater than 100 feet (30 480 mm) above the ground. Greater heights are permitted where

approved and located so as not to create a hazard or danger to the public.

**H109.2 Required clearance.** The bottom coping of every ground sign shall be not less than 3 feet (914 mm) above the ground or street level, which space can be filled with platform decorative trim or light wooden construction.

**H109.3 Wood anchors and supports.** Where wood anchors or supports are embedded in the soil, the wood shall be pressure treated with an approved preservative.

## SECTION H110 ROOF SIGNS

**H110.1 General.** Roof signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in Sections H106.1.1 and H107.1. Provisions shall be made for electric grounding of metallic parts. Where combustible materials are permitted in letters or other ornamental features, wiring and tubing shall be kept free and insulated therefrom. Roof signs shall be so constructed as to leave a clear space of not less than 6 feet (1829 mm) between the roof level and the lowest part of the sign and shall have at least 5 feet (1524 mm) clearance between the vertical supports thereof. No portion of any roof sign structure shall project beyond an exterior wall.

**Exception:** Signs on flat roofs with every part of the roof accessible.

**H110.2 Bearing plates.** The bearing plates of roof signs shall distribute the load directly to or upon masonry walls, steel roof girders, columns or beams. The building shall be designed to avoid overstress of these members.

**H110.3 Height of solid signs.** A roof sign having a solid surface shall not exceed, at any point, a height of 24 feet (7315 mm) measured from the roof surface.

**H110.4 Height of open signs.** Open roof signs in which the uniform open area is not less than 40 percent of total gross area shall not exceed a height of 75 feet (22 860 mm) on buildings of Type 1 or Type 2 construction. On buildings of other construction types, the height shall not exceed 40 feet (12 192 mm). Such signs shall be thoroughly secured to the building upon which they are installed, erected or constructed by iron, metal anchors, bolts, supports, chains, stranded cables, steel rods or braces and they shall be maintained in good condition.

**H110.5 Height of closed signs.** A closed roof sign shall not be erected to a height greater than 50 feet (15 240 mm) above the roof of buildings of Type 1 or Type 2 construction, nor more than 35 feet (10 668 mm) above the roof of buildings of Type 3, 4 or 5 construction.

## SECTION H111 WALL SIGNS

**H111.1 Materials.** Wall signs which have an area exceeding 40 square feet (3.72 m<sup>2</sup>) shall be constructed of metal or other approved noncombustible material, except for nailing rails and as provided for in Sections H106.1.1 and H107.1.

**H111.2 Exterior wall mounting details.** Wall signs attached to exterior walls of solid masonry, concrete or stone shall be safely and securely attached by means of metal anchors, bolts or expansion screws of not less than  $\frac{3}{8}$  inch (9.5 mm) diameter and shall be embedded at least 5 inches (127 mm). Wood blocks shall not be used for anchorage, except in the case of wall signs attached to buildings with walls of wood. A wall sign shall not be supported by anchorages secured to an unbraced parapet wall.

**H111.3 Extension.** Wall signs shall not extend above the top of the wall, nor beyond the ends of the wall to which the signs are attached unless such signs conform to the requirements for roof signs, projecting signs or ground signs.

## SECTION H112 PROJECTING SIGNS

**H112.1 General.** Projecting signs shall be constructed entirely of metal or other noncombustible material and securely attached to a building or structure by metal supports such as bolts, anchors, supports, chains, guys or steel rods. Staples or nails shall not be used to secure any projecting sign to any building or structure. The dead load of projecting signs not parallel to the building or structure and the load due to wind pressure shall be supported with chains, guys or steel rods having net cross-sectional dimension of not less than  $\frac{3}{8}$  inch (9.5 mm) diameter. Such supports shall be erected or maintained at an angle of at least 45 percent (0.78 rad) with the horizontal to resist the dead load and at angle of 45 percent (0.78 rad) or more with the face of the sign to resist the specified wind pressure. If such projecting sign exceeds 30 square feet (2.8 m<sup>2</sup>) in one facial area, there shall be provided at least two such supports on each side not more than 8 feet (2438 mm) apart to resist the wind pressure.

**H112.2 Attachment of supports.** Supports shall be secured to a bolt or expansion screw that will develop the strength of the supporting chains, guys or steel rods, with a minimum  $\frac{5}{8}$ -inch (15.9 mm) bolt or lag screw, by an expansion shield. Turn buckles shall be placed in chains, guys or steel rods supporting projecting signs.

**H112.3 Wall mounting details.** Chains, cables, guys or steel rods used to support the live or dead load of projecting signs are permitted to be fastened to solid masonry walls with expansion bolts or by machine screws in iron supports, but such supports shall not be attached to an unbraced parapet wall. Where the supports must be fastened to walls made of wood, the supporting anchor bolts must go through the wall and be plated or fastened on the inside in a secure manner.

**H112.4 Height limitation.** A projecting sign shall not be erected on the wall of any building so as to project above the roof or cornice wall or above the roof level where there is no cornice wall; except that a sign erected at a right angle to the building, the horizontal width of which sign is perpendicular to such a wall and does not exceed 18 inches (457 mm), is permitted to be erected to a height not exceeding 2 feet (610 mm) above the roof or cornice wall or above the roof level where there is no cornice wall. A sign attached to a corner of a building and parallel to the vertical line of such corner shall be deemed to be erected at a right angle to the building wall.

**H112.5 Additional loads.** Projecting sign structures which will be used to support an individual on a ladder or other servicing device, whether or not specifically designed for the servicing device, shall be capable of supporting the anticipated additional load, but not less than a 100-pound (445 N) concentrated horizontal load and a 300-pound (1334 N) concentrated vertical load applied at the point of assumed or most eccentric loading. The building component to which the projecting sign is attached shall also be designed to support the additional loads.

### SECTION H113 MARQUEE SIGNS

**H113.1 Materials.** Marquee signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in Sections H106.1.1 and H107.1.

**H113.2 Attachment.** Marquee signs shall be attached to approved marquees that are constructed in accordance with Section 3106.

**H113.3 Dimensions.** Marquee signs, whether on the front or side, shall not project beyond the perimeter of the marquee.

**H113.4 Height limitation.** Marquee signs shall not extend more than 6 feet (1829 mm) above, nor 1 foot (305 mm) below such marquee, but under no circumstances shall the sign or signs have a vertical dimension greater than 8 feet (2438 mm).

### SECTION H114 PORTABLE SIGNS

**H114.1 General.** Portable signs shall conform to requirements for ground, roof, projecting, flat and temporary signs where such signs are used in a similar capacity. The requirements of this section shall not be construed to require portable signs to have connections to surfaces, tie-downs or foundations where provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

**TABLE 4-A  
SIZE, THICKNESS AND TYPE OF GLASS PANELS IN SIGNS**

MAXIMUM SIZE OF EXPOSED PANEL		MINIMUM THICKNESS OF GLASS (inches)	TYPE OF GLASS
Any dimension (inches)	Area (square inches)		
30	500	$\frac{1}{8}$	Plain, plate or wired
45	700	$\frac{3}{16}$	Plain, plate or wired
144	3,600	$\frac{1}{4}$	Plain, plate or wired
> 144	> 3,600	$\frac{1}{4}$	Wired glass

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.

**TABLE 4-B  
THICKNESS OF PROJECTION SIGN**

PROJECTION (feet)	MAXIMUM THICKNESS (feet)
5	2
4	2.5
3	3
2	3.5
1	4

For SI: 1 foot = 304.8 mm.

### SECTION H115 REFERENCED STANDARDS

ASTM D 635—03	Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position	H107.1.1
NFPA 70—08	National Electrical Code	H106.1, H106.2
NFPA 701—99	Methods of Fire Test for Flame Propagation of Textiles and Films	H106.1.1

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### APPENDIX I – PATIO COVERS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>			X																	
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>		X																		
<i>Chapter / Section</i>																				
I101		X																		
I102		X																		
I103		X																		





## APPENDIX I

# PATIO COVERS

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION I101 GENERAL

**I101.1 General.** Patio covers shall be permitted to be detached from or attached to dwelling units. Patio covers shall be used only for recreational, outdoor living purposes and not as carports, garages, storage rooms or habitable rooms.

### SECTION I102 DEFINITIONS

**I102.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *California Building Code* for general definitions.

**PATIO COVER.** A structure with open or glazed walls which is used for recreational, outdoor living purposes associated with a dwelling unit.

### SECTION I103 EXTERIOR WALLS AND OPENINGS

**I103.1 Enclosure walls.** Enclosure walls shall be permitted to be of any configuration, provided the open or glazed area of the longer wall and one additional wall is equal to at least 65 percent of the area below a minimum of 6 feet 8 inches (2032 mm) of each wall, measured from the floor. Openings shall be permitted to be enclosed with insect screening, approved translucent or transparent plastic not more than 0.125 inch (3.2 mm) in thickness, glass conforming to the provisions of Chapter 24 or any combination of the foregoing.

**I103.2 Light, ventilation and emergency egress.** Exterior openings of the dwelling unit required for light and ventilation shall be permitted to open into a patio structure. However, the patio structure shall be unenclosed if such openings are serving as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as an exit from the dwelling unit, the patio structure, unless unenclosed, shall be provided with exits conforming to the provision of Chapter 10.

### SECTION I104 HEIGHT

**I104.1 Height.** Patio covers shall be limited to one-story structures not exceeding 12 feet (3657 mm) in height.

### SECTION I105 STRUCTURAL PROVISIONS

**I105.1 Design loads.** Patio covers shall be designed and constructed to sustain, within the stress limits of this code, all dead loads plus a minimum vertical live load of 10 pounds per square foot (0.48 kN/m<sup>2</sup>) except that snow loads shall be used where such snow loads exceed this minimum. Such patio covers shall be designed to resist the minimum wind and seismic loads set forth in this code.

**I105.2 Footings.** In areas with a frost depth of zero, a patio cover shall be permitted to be supported on a concrete slab on grade without footings, provided the slab conforms to the provisions of Chapter 19 of this code, is not less than 3½ inches (89 mm) thick and further provided that the columns do not support loads in excess of 750 pounds (3.36 kN) per column.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### APPENDIX J – GRADING

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDPD				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>			X								X									
<i>Adopt entire chapter as amended (amended sections listed below)</i>									X	X		X								
<i>Adopt only those sections that are listed below</i>							X	X												
<i>Chapter / Section</i>																				
J101							X	X												
J102							X	X												
J104.4									X	X		X								
J105							X	X												
J106.2							X	X	X	X		X								
J107							X	X												
J107.5							X	X	X	X		X								
J108							X	X												
J109							X	X												
J110							X	X												
J111							X	X												
J112							X	X	X	X		X								



## APPENDIX J

# GRADING

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION J101 GENERAL

**J101.1 Scope.** The provisions of this chapter apply to grading, excavation and earthwork construction, including fills and embankments. Where conflicts occur between the technical requirements of this chapter and the geotechnical report, the geotechnical report shall govern.

**J101.2 Flood hazard areas.** The provisions of this chapter shall not apply to grading, excavation and earthwork construction, including fills and embankments, in floodways within flood hazard areas established in Section 1612.3 or in flood hazard areas where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed work will not result in any increase in the level of the base flood.

### SECTION J102 DEFINITIONS

**J102.1 Definitions.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *California Building Code* for general definitions.

**BENCH.** A relatively level step excavated into earth material on which fill is to be placed.

**COMPACTION.** The densification of a fill by mechanical means.

**CUT.** See "Excavation."

**DOWN DRAIN.** A device for collecting water from a swale or ditch located on or above a slope, and safely delivering it to an approved drainage facility.

**EROSION.** The wearing away of the ground surface as a result of the movement of wind, water or ice.

**EXCAVATION.** The removal of earth material by artificial means, also referred to as a cut.

**FILL.** Deposition of earth materials by artificial means.

**GRADE.** The vertical location of the ground surface.

**GRADE, EXISTING.** The grade prior to grading.

**GRADE, FINISHED.** The grade of the site at the conclusion of all grading efforts.

**GRADING.** An excavation or fill or combination thereof.

**KEY.** A compacted fill placed in a trench excavated in earth material beneath the toe of a slope.

**SLOPE.** An inclined surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance.

**TERRACE.** A relatively level step constructed in the face of a graded slope for drainage and maintenance purposes.

### SECTION J103 PERMITS REQUIRED

**J103.1 Permits required.** Except as exempted in Section J103.2, no grading shall be performed without first having obtained a permit therefor from the building official. A grading permit does not include the construction of retaining walls or other structures.

**J103.2 Exemptions.** A grading permit shall not be required for the following:

1. Grading in an isolated, self-contained area, provided there is no danger to the public, and that such grading will not adversely affect adjoining properties.
2. Excavation for construction of a structure permitted under this code.
3. Cemetery graves.
4. Refuse disposal sites controlled by other regulations.
5. Excavations for wells, or trenches for utilities.
6. Mining, quarrying, excavating, processing or stockpiling rock, sand, gravel, aggregate or clay controlled by other regulations, provided such operations do not affect the lateral support of, or significantly increase stresses in, soil on adjoining properties.
7. Exploratory excavations performed under the direction of a registered design professional.

Exemption from the permit requirements of this appendix shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction.

### SECTION J104 PERMIT APPLICATION AND SUBMITTALS

**J104.1 Submittal requirements.** In addition to the provisions of Section 105.3, the applicant shall state the estimated quantities of excavation and fill.

**J104.2 Site plan requirements.** In addition to the provisions of Section 107, a grading plan shall show the existing grade and finished grade in contour intervals of sufficient clarity to indicate the nature and extent of the work and show in detail that it complies with the requirements of this code. The plans shall show the existing grade on adjoining properties in sufficient detail to identify how grade changes will conform to the requirements of this code.

**J104.3 Geotechnical report.** A geotechnical report prepared by a registered design professional shall be provided. The report shall contain at least the following:

1. The nature and distribution of existing soils;
2. Conclusions and recommendations for grading procedures;
3. Soil design criteria for any structures or embankments required to accomplish the proposed grading; and
4. Where necessary, slope stability studies, and recommendations and conclusions regarding site geology.

**Exception:** A geotechnical report is not required where the building code official determines that the nature of the work applied for is such that a report is not necessary.

**J104.4 Liquefaction study.** For sites with mapped maximum considered earthquake spectral response accelerations at short periods ( $S_s$ ) greater than 0.5g as determined by Section 1613, a study of the liquefaction potential of the site shall be provided, and the recommendations incorporated in the plans.

**Exceptions:**

1. A liquefaction study is not required where the building official determines from established local data that the liquefaction potential is low.
2. [OSHPD 1, 2, & 4] *Exception 1 not permitted by OSHPD.*

## SECTION J105 INSPECTIONS

**J105.1 General.** Inspections shall be governed by Section 110, *Chapter 1, Division II* of this code.

**J105.2 Special inspections.** The special inspection requirements of Section 1704.7 shall apply to work performed under a grading permit where required by the building official.

## SECTION J106 EXCAVATIONS

**J106.1 Maximum slope.** The slope of cut surfaces shall be no steeper than is safe for the intended use, and shall be no steeper than two units horizontal to one unit vertical (50-percent slope) unless the owner or authorized agent furnishes a geotechnical report justifying a steeper slope.

**Exceptions:**

1. A cut surface shall be permitted to be at a slope of 1.5 units horizontal to one unit vertical (67-percent slope) provided that all of the following are met:
  - 1.1. It is not intended to support structures or surcharges.
  - 1.2. It is adequately protected against erosion.
  - 1.3. It is no more than 8 feet (2438 mm) in height.
  - 1.4. It is approved by the building code official.
  - 1.5. Ground water is not encountered.

2. A cut surface in bedrock shall be permitted to be at a slope of one unit horizontal to one unit vertical (100-percent slope).

### **J106.2 Earth retaining shoring. [DSA-SS & DSA-SS/CC]**

**J106.2.1 General.** *The requirements of this section shall apply to temporary and permanent earth retaining shoring using soldier piles and lagging with or without tie-back anchors in soil or rock, only when existing or new DSA-SS, DSA-SS/CC or OSHPD 1 or 4 facilities are affected. Shoring used as construction means and methods only, which does not affect existing or new DSA-SS, DSA-SS/CC or OSHPD 1 or 4 facilities, are not regulated by DSA or OSHPD and shall satisfy the requirements of the authorities having jurisdiction.*

*Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections J106.2.2 through J106.2.8.*

**J106.2.2 Duration.** *Shoring shall be considered temporary when elements of the shoring will be exposed to site conditions for a period of less than one (1) year, and shall be considered permanent otherwise. Permanent shoring shall account for the increase in lateral soil pressure due to earthquake. At the end of the construction period, the existing and new structures shall not rely on the temporary shoring for support in any way. Wood components shall not be used for permanent shoring lasting more than two (2) years. Wood components of the temporary shoring that may affect the performance of permanent structure shall be removed after the shoring is no longer required.*

*All components of the shoring shall have corrosion protection or preservative treatment for their expected duration. Wood components of the temporary shoring that will not be removed shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall be identified in accordance with Section 2303.1.8.1.*

**J106.2.3 Surcharge.** *Surcharge pressure due to footings, traffic or other sources shall be considered in design. If the footing surcharge is located within the semicircular distribution or bulb of earth pressure (when shoring is located close to a footings), lagging shall be designed for lateral earth pressure due to footing surcharge. Soil arching effects may be considered in the design of lagging. Underpinning of the footing may be used in lieu of designing the shoring and lagging for surcharge pressure. Alternatively, continuously contacting drilled pier shafts near the footings shall be permitted. The lateral surcharge design pressure shall be derived using Boussinesq equations modified for the distribution of stresses in an elastic medium due to a uniform, concentrated or line surface load as appropriate and soil arching effects.*

**J106.2.4 Design and testing:** *Except for the modifications as set forth in Sections J106.2.4.1 and J106.2.4.2 below, all Prestressed Rock and Soil Tie-back Anchors shall be designed and tested in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors (PTI-2004).*

**J106.2.4.1 Geotechnical requirements:** *The geotechnical report for the earth retaining shoring shall address the following:*

1. Minimum diameter and minimum spacing for the anchors including consideration of group effects.
2. Maximum unbonded length and minimum bonded length of the tie-back anchors.
3. Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.
4. Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress for the anchor. For permanent anchors, a minimum factor of safety of 2.0 shall be applied to ground soil interface as required by PTI-2004 Section 6.6.
5. Minimum grout pressure for installation and post-grout pressure for the anchor. The presumptive post grout pressure of 300 psi may be used for all soil type.
6. Class I corrosion protection is required for all permanent anchors. The geotechnical report shall specify the corrosion protection recommendations for temporary anchors.
7. Performance test for the anchors shall be at a minimum of two (2) times the design loads and shall not exceed 80 percent of the specified minimum tensile strength of the anchor rod. A creep test is required for all prestressed anchors that are performance tested. All production anchors shall be tested at 150 percent of design loads and shall not be greater than 70 percent of the specified minimum tensile strength of the anchor rod.
8. Earth pressure, surcharge pressure and the seismic increment of earth pressure loading, when applicable.
9. Maximum recommended lateral deformation at the top of the soldier pile, at the tie-back anchor locations, and the drilled pier concrete shafts at the lowest grade level.
10. Allowable vertical soil bearing pressure friction resistance, and lateral passive soil resistance for the drilled pier concrete shafts and associated factors of safety for these allowable capacities.
11. Soil-pier shaft/pile interaction assumptions and lateral soil stiffness to be used in design for drilled pier concrete shaft or pile lateral loads.
12. Acceptable drilling methods.
13. Geotechnical observation and monitoring recommendations.

**J106.2.4.2 Structural requirements:**

1. Tendons shall be thread-bar anchors conforming to ASTM A 722.

2. Anchor design loads shall be based upon the load combinations in Section 1605A.3.1 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.
3. The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge.
4. Design of shoring system shall account for as-built locations of soil anchors considering all specified construction tolerances in Section J106.2.8.
5. Design of shoring system shall account for both short and long-term deformation.

**J106.2.4.3 Testing of tie-back anchors:**

1. The geotechnical engineer shall keep a record at job site of all test loads, total anchor movement, and report their accuracy.
2. If a tie-back anchor initially fails the testing requirements, the anchor shall be permitted to be regouted and retested. If anchor continues to fail, the followings steps shall be taken:
  - a. The contractor shall determine the cause of failure – variations of the soil conditions, installation methods, materials, etc.
  - b. The contractor shall propose a solution to remedy the problem. The proposed solution will need to be reviewed and approved by the geotechnical engineer, shoring design engineer and building official.
3. After a satisfactory test, each anchor shall be locked-off in accordance with Section 8.4 of PTI 2004.
4. The shoring design engineer shall specify design loads for each anchor.

**J106.2.5 Construction.** *The construction procedure shall address the following:*

1. Holes drilled for piles/tie-back anchors shall be done without detrimental loss of ground, sloughing or caving of materials and without endangering previously installed shoring members or existing foundations.
2. Drilling of earth anchor shafts for tie-backs shall occur when the drill bench reaches two to three feet below the level of the tie-back pockets.
3. Casing or other methods shall be used where necessary to prevent loss of ground and collapse of the hole.
4. The drill cuttings from earth anchor shaft shall be removed prior to anchor installation.
5. Unless tremie methods are used, all water and loose materials shall be removed from the holes prior to installing piles/tie-backs.
6. Tie-back anchor rods with attached centralizing devices shall be installed into the shaft or through



*the drill casing. Centralizing device shall not restrict movement of the grout.*

7. *After lagging installation, voids between lagging and soil shall be backfilled immediately to the full height of lagging.*
8. *The soldier piles shall be placed within specified tolerances in the drilled hole and braced against displacement during grouting. Fill shafts with concrete up to top of footing elevation, rest of the shaft can generally be filled with lean concrete. Excavation for lagging shall not be started until concrete has achieved sufficient strength for all anticipated loads as determined by the shoring design engineer.*
9. *Where boulders and/or cobbles have been identified in the geotechnical reports, contractor shall be prepared to address boulders and/or cobbles that may be encountered during the drilling of soldier piles and tie-back anchors.*
10. *The grouting equipment shall produce grout free of lumps and indispensed cement. The grouting equipment shall be sized to enable the grout to be pumped in continuous operation. The mixer shall be capable of continuously agitating the grout.*
11. *The quantity of grout and grout pressure shall be recorded. The grout pressure shall be controlled to prevent excessive heave in soils or fracturing rock formations.*
12. *If post-grouting is required, post-grouting operation shall be performed after initial grout has set for 24 hours in the bond length only. Tie-backs shall be grouted over a sufficient length (anchor bond length) to transfer the maximum anchor force to the anchor grout.*
13. *Testing of anchors may be performed after post-grouting operations, provided grout has reached strength of 3,000 psi as required by PTI-2004 Section 6.11.*
14. *Anchor rods shall be tensioned straight and true. Excavation directly below the anchors shall not continue before those anchors are tested.*

#### **J106.2.6 Inspection, survey monitoring and observation.**

1. *The shoring design engineer or his designee shall make periodic inspections of the job site for the purpose of observing the installation of shoring system, testing of tie-back anchors and monitoring of survey.*
2. *Testing, inspection and observation shall be in accordance with testing, inspection and observation requirements approved by the building official. The following activities and materials shall be tested, inspected, or observed by the special inspector and geotechnical engineer:*
  - a. *Sampling and testing of concrete in soldier pile and tie-back anchor shafts.*
  - b. *Fabrication of tie-back anchor pockets on soldier beams*
  - c. *Installation and testing of tie-back anchors.*
  - d. *Survey monitoring of soldier pile and tie-back load cells.*
  - e. *Survey monitoring of existing buildings.*
3. *A complete and accurate record of all soldier pile locations, depths, concrete strengths, tie-back locations and lengths, tie-back grout strength, quantity of concrete per pile, quantity of grout per tie-back and applied tie-back loads shall be maintained by the special inspector and geotechnical engineer. The shoring design engineer shall be notified of any unusual conditions encountered during installation.*
4. *Calibration data for each test jack, pressure gauge and master pressure gauge shall be verified by the special inspector and geotechnical engineer. The calibration tests shall be performed by an independent testing laboratory and within 120 calendar days of the data submitted.*
5. *Monitoring points shall be established at the top and at the anchor heads of selected soldier piles and at intermediate intervals as considered appropriate by the geotechnical engineer.*
6. *Control points shall be established outside the area of influence of the shoring system to ensure the accuracy of the monitoring readings.*
7. *The periodic basis of shoring monitoring, as a minimum, shall be as follows:*
  - a. *Initial monitoring shall be performed prior to any excavation.*
  - b. *Once excavation has begun, the periodic readings shall be taken weekly until excavation reaches the estimated subgrade elevation and the permanent foundation is complete.*
  - c. *If performance of the shoring is within established guidelines, shoring design engineer may permit the periodic readings to be bi-weekly. Once initiated, bi-weekly readings shall continue until the building slab at ground floor level is completed and capable of transmitting lateral loads to the permanent structure. Thereafter, readings can be monthly.*
  - d. *Where the building has been designed to resist lateral earth pressures, the periodic monitoring of the soldier piles and adjacent structure can be discontinued once the ground floor diaphragm and subterranean portion of the structure is capable of resisting lateral soil loads and approved by the shoring design engineer, geotechnical engineer and building official.*
  - e. *Additional readings shall be taken when requested by the special inspector, shoring*

design engineer, geotechnical engineer or building official.

8. Monitoring reading shall be submitted to the shoring design engineer, engineer in responsible charge, and building official within three working days after they are conducted. Monitoring readings shall be accurate to within 0.01 feet. Results are to be submitted in tabular form showing at least the initial date of monitoring and reading, current monitoring date and reading and difference between the two readings.
9. If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches  $\frac{1}{2}$  inch or soldier piles reaches 1 inch all excavation activities shall be suspended. The geotechnical and shoring design engineer shall determine the cause of movement, if any, and recommend corrective measures, if necessary, before excavation continues.
10. If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches  $\frac{3}{4}$  inch or soldier piles reaches  $1\frac{1}{2}$  inches all excavation activities shall be suspended until the causes, if any, can be determined. Supplemental shoring shall be devised to eliminate further movement and the building official shall review and approve the supplemental shoring before excavation continues.
11. Monitoring of tie-back anchor loads:
  - a. Load cells shall be installed at the tie-back heads adjacent to buildings at maximum interval of 50 feet, with a minimum of one load cell per wall.
  - b. Load cell readings shall be taken once a day during excavation and once a week during the remainder of construction.
  - c. Load cell readings shall be submitted to the geotechnical engineer, shoring design engineer, engineer in responsible charge and building official.
  - d. Load cell readings can be terminated once the temporary shoring no longer provides support for the buildings.

**J106.2.7 Monitoring of existing DSA-SS, DSA-SS/CC, and OSHPD 1 and 4 structures**

1. The contractor shall complete a written and photographic log of all existing DSA-SS, DSA-SS/CC, and OSHPD 1 & 4 structures within 100 ft or three times depth of shoring, prior to construction. A licensed surveyor shall document all existing substantial cracks in adjacent existing structures.
2. The contractor shall document existing condition of wall cracks adjacent to shoring walls prior to start of construction.

3. The contractor shall monitor existing walls for movement or cracking that may result from adjacent shoring.
4. If excessive movement or visible cracking occurs, the contractor shall stop work and shore/reinforce excavation and contact the shoring design engineer and building official.
5. Monitoring of the existing structure shall be at reasonable intervals as required by the registered design professional subject to approval of the building official. Monitoring shall be performed by a licensed surveyor and shall consist of vertical and lateral movement of the existing structures. Prior to starting shoring installation a preconstruction meeting shall take place between the contractor, shoring design engineer, surveyor, geotechnical engineer and building official to identify monitoring locations on existing buildings.
6. If in the opinion of the building official or shoring design engineer, monitoring data indicate excessive movement or other distress, all excavation shall cease until the geotechnical engineer and shoring design engineer investigate the situation and make recommendations for remediation or continuing.
7. All reading and measurements shall be submitted to the building official and shoring design engineer.

**J106.2.8 Tolerances.** The following tolerances shall be specified on the construction documents.

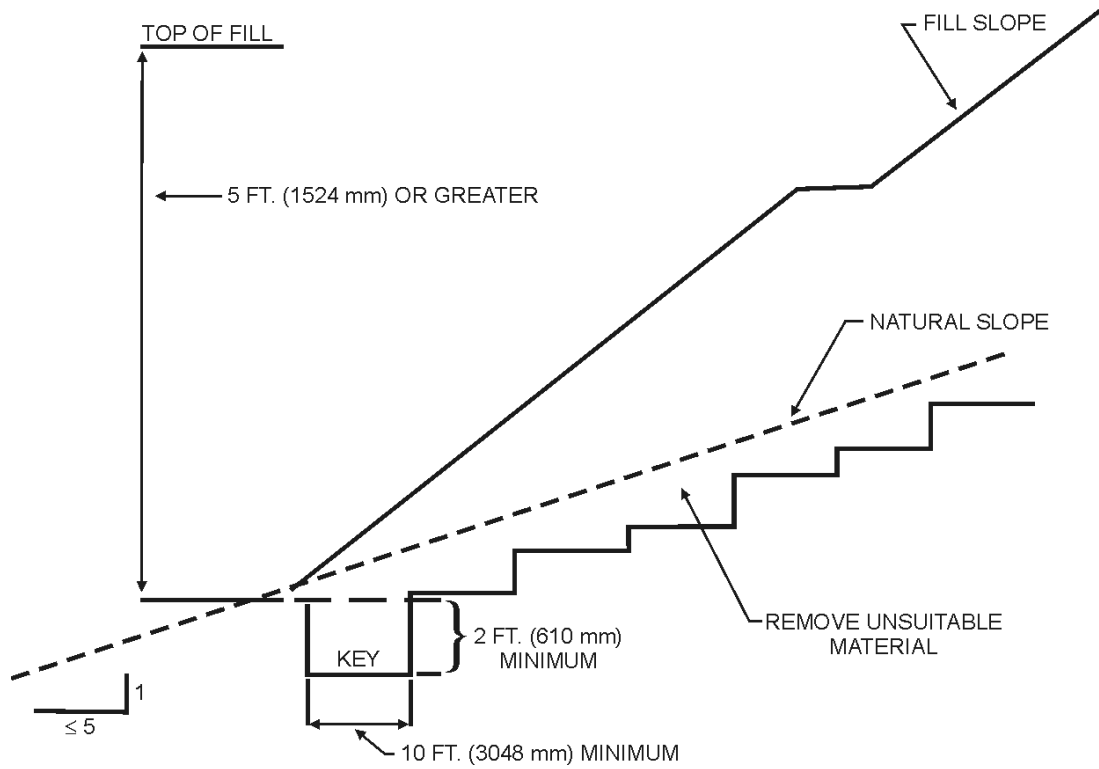
1. Soldier piles:
  - i. Horizontal and vertical construction tolerances for the soldier pile locations.
  - ii. Soldier pile plumbness requirements (angle with vertical line).
2. Tie-back anchors:
  - i. Allowable deviation of anchor projected angle from specified vertical and horizontal design projected angle.
  - ii. Anchor clearance to the existing/new utilities and structures.

## SECTION J107 FILLS

**J107.1 General.** Unless otherwise recommended in the geotechnical report, fills shall comply with the provisions of this section.

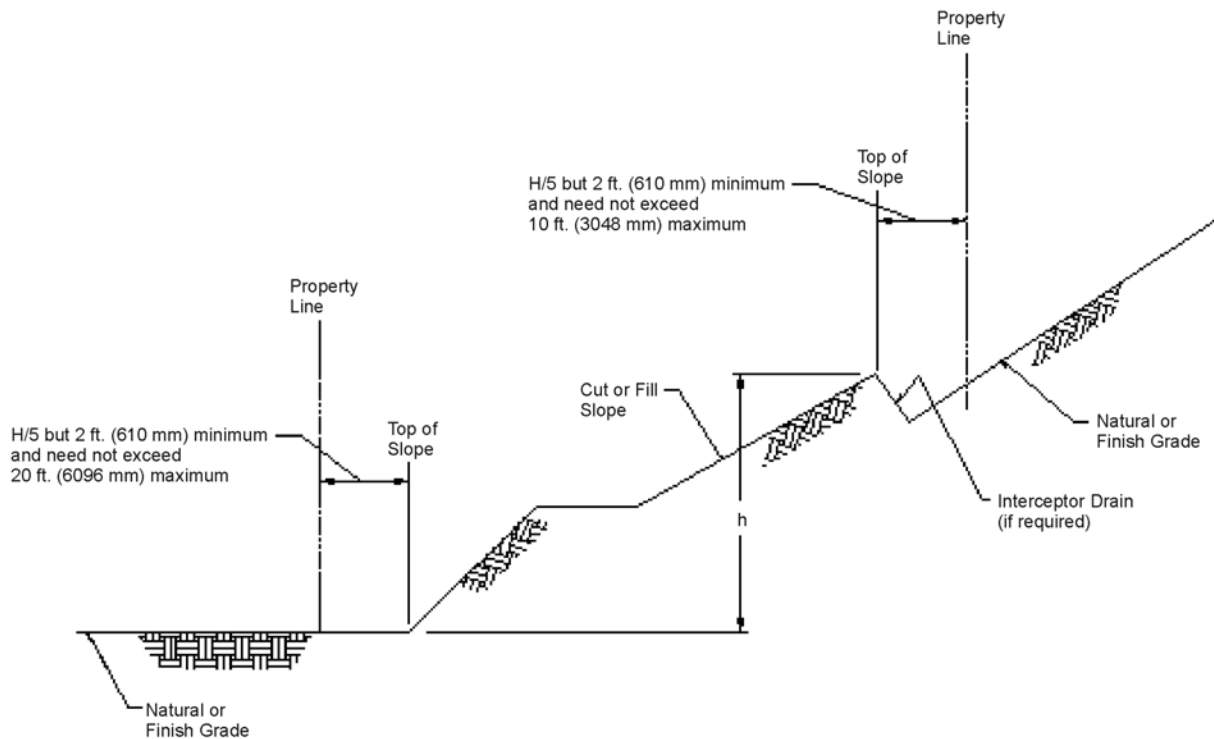
**J107.2 Surface preparation.** The ground surface shall be prepared to receive fill by removing vegetation, topsoil and other unsuitable materials, and scarifying the ground to provide a bond with the fill material.

**J107.3 Benching.** Where existing grade is at a slope steeper than five units horizontal to one unit vertical (20-percent slope) and the depth of the fill exceeds 5 feet (1524 mm) benching shall be provided in accordance with Figure J107.3. A key shall be provided which is at least 10 feet (3048 mm) in width and 2 feet (610 mm) in depth.



For SI: 1 foot = 304.8 mm.

**FIGURE J107.3  
BENCHING DETAILS**



For SI: 1 foot = 304.8 mm.

**FIGURE J108.1  
DRAINAGE DIMENSIONS**

**J107.4 Fill material.** Fill material shall not include organic, frozen or other deleterious materials. No rock or similar irreducible material greater than 12 inches (305 mm) in any dimension shall be included in fills.

**J107.5 Compaction.** All fill material shall be compacted to 90 percent of maximum density as determined by ASTM D 1557, Modified Proctor, in lifts not exceeding 12 inches (305 mm) in depth.

*[DSA-SS & DSA-SS/CC] This section establishes minimum requirements only.*

**J107.6 Maximum slope.** The slope of fill surfaces shall be no steeper than is safe for the intended use. Fill slopes steeper than two units horizontal to one unit vertical (50-percent slope) shall be justified by a geotechnical report or engineering data.

## SECTION J108 SETBACKS

**J108.1 General.** Cut and fill slopes shall be set back from the property lines in accordance with this section. Setback dimensions shall be measured perpendicular to the property line and shall be as shown in Figure J108.1, unless substantiating data is submitted justifying reduced setbacks.

**J108.2 Top of slope.** The setback at the top of a cut slope shall not be less than that shown in Figure J108.1, or than is required to accommodate any required interceptor drains, whichever is greater.

**J108.3 Slope protection.** Where required to protect adjacent properties at the toe of a slope from adverse effects of the grading, additional protection, approved by the *building official*, shall be included. Such protection may include but shall not be limited to:

1. Setbacks greater than those required by Figure J108.1.
2. Provisions for retaining walls or similar construction.
3. Erosion protection of the fill slopes.
4. Provision for the control of surface waters.

## SECTION J109 DRAINAGE AND TERRACING

**J109.1 General.** Unless otherwise recommended by a registered design professional, drainage facilities and terracing shall be provided in accordance with the requirements of this section.

**Exception:** Drainage facilities and terracing need not be provided where the ground slope is not steeper than 3 horizontal to 1 vertical (33 percent).

**J109.2 Terraces.** Terraces at least 6 feet (1829 mm) in width shall be established at not more than 30-foot (9144 mm) vertical intervals on all cut or fill slopes to control surface drainage and debris. Suitable access shall be provided to allow for cleaning and maintenance.

Where more than two terraces are required, one terrace, located at approximately mid-height, shall be at least 12 feet (3658 mm) in width.

Swales or ditches shall be provided on terraces. They shall have a minimum gradient of 20 horizontal to 1 vertical (5 percent) and shall be paved with concrete not less than 3 inches (76 mm) in thickness, or with other materials suitable to the application. They shall have a minimum depth of 12 inches (305 mm) and a minimum width of 5 feet (1524 mm).

A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (1256 m<sup>2</sup>) (projected) without discharging into a down drain.

**J109.3 Interceptor drains.** Interceptor drains shall be installed along the top of cut slopes receiving drainage from a tributary width greater than 40 feet (12 192 mm), measured horizontally. They shall have a minimum depth of 1 foot (305 mm) and a minimum width of 3 feet (915 mm). The slope shall be approved by the building official, but shall not be less than 50 horizontal to 1 vertical (2 percent). The drain shall be paved with concrete not less than 3 inches (76 mm) in thickness, or by other materials suitable to the application. Discharge from the drain shall be accomplished in a manner to prevent erosion and shall be approved by the building official.

**J109.4 Drainage across property lines.** Drainage across property lines shall not exceed that which existed prior to grading. Excess or concentrated drainage shall be contained on site or directed to an approved drainage facility. Erosion of the ground in the area of discharge shall be prevented by installation of nonerosive down drains or other devices.

## SECTION J110 EROSION CONTROL

**J110.1 General.** The faces of cut and fill slopes shall be prepared and maintained to control erosion. This control shall be permitted to consist of effective planting.

**Exception:** Erosion control measures need not be provided on cut slopes not subject to erosion due to the erosion-resistant character of the materials.

Erosion control for the slopes shall be installed as soon as practicable and prior to calling for final inspection.

**J110.2 Other devices.** Where necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety.

## SECTION J111 REFERENCED STANDARDS

ASTM D 1557-e01	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lb/ft <sup>3</sup> (2,700kN-m/m <sup>3</sup> )].	J107.6
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**SECTION J112**  
**VIBRO STONE COLUMNS**  
**FOR GROUND IMPROVEMENT**  
**[DSA-SS & DSA-SS/CC]**

**J112.1 General.** This section shall apply to vibro stone columns (VSCs) for ground improvement using unbounded aggregate materials. Vibro stone column provisions in this section are intended to increase bearing capacity, reduce settlements and mitigate liquefaction for shallow foundations. These requirements shall not be used for grouted or bonded stone columns, ground improvement for deep foundation elements, or changing site class. VSCs shall not be considered a deep foundation element. Ground improvement shall be installed under the entire building/structure footprint and not under isolated foundation elements only. Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections J112.2 through J112.5.

**J112.2 Geotechnical report.** The geotechnical report shall specify vibro stone column requirements to ensure uniformity in total and differential immediate settlement, long term settlement and earthquake induced settlement.

1. Soil compaction shall be in accordance with California Geological Survey (CGS) Special Publication 117A (SP-117A): Guidelines for Evaluating and Mitigating Seismic Hazard in California.
2. Area replacement ratio for the compaction elements and the basis of its determination shall be explained. Minimum factor of safety for soil compaction shall be in accordance with SP-117A.
3. Depth of soil compaction elements and extent beyond the footprint of structures/foundation shall be defined. Extent beyond the foundation shall be half the depth of the VSCs with a minimum of 10 ft or an approved alternative.
4. Minimum diameter and maximum spacing of soil compaction elements shall be specified. VSCs shall not be less than 2 feet in diameter, and center to center spacing shall not exceed 8 feet.
5. The modulus of subgrade reactions for shallow foundations shall account for the presence of compaction elements.
6. The modulus of subgrade reactions, long-term settlement and post-earthquake settlement shall be specified along with expected total and differential settlements for design.
7. The acceptance criteria for the cone penetration test (CPT) in accordance with ASTM D 3441 complemented by the standard penetration test (SPT) in accordance with ASTM D 1586, if necessary, to verify soil improvement shall be specified.

dance with ASTM D 1586, if necessary, to verify soil improvement shall be specified

8. The requirements for special inspection and observation by the geotechnical engineer shall be specified.
9. A final verified report (FVR) documenting the installation of the ground improvement system and confirming that the ground improvement acceptance criteria have been met shall be prepared by the geotechnical engineer and submitted to the enforcement agency for review and approval.

**J112.3 Shallow foundations.** VSCs under the shallow foundation shall be located symmetrically around the centroid of the footing or load.

1. There shall be a minimum of four stone columns under each isolated or continuous/combined footing or approved equivalent.
2. The VSCs or deep foundation elements shall not be used to resist tension or overturning uplift from the shallow foundations.
3. The foundation design for the shallow foundation shall consider the increased vertical stiffness of the VSCs as point supports for analysis, unless it is substantiated that the installation of the VSCs result in improvement of the surrounding soils such that the modulus of subgrade reaction, long term settlement, and post-earthquake settlement can be considered uniform throughout.

**J112.4 Installation.** VSCs shall be installed with vibratory probes. Vertical columns of compacted unbounded aggregate shall be formed through the soils to be improved by adding gravel near the tip of the vibrator and progressively raising and repenetrating the vibrator which will results in the gravel being pushed into the surrounding soil. Gravel aggregate for VSCs shall be well graded with a maximum size of 6 inches and not more than 10 percent smaller than  $\frac{3}{8}$  inch after compaction.

**J112.5 Construction documents.** Construction documents for VSCs, as a minimum, shall include the following:

1. Size, depth and location of VSCs.
2. Extent of soil improvements along with building/structure foundation outlines.
3. Field verification requirements and acceptance criteria using CPT/SPT.
4. The locations where CPT/SPT shall be performed.
5. The testing, inspection and observation (TIO) program shall indicate the inspection and observation required for the VSCs.

## APPENDIX K

# GROUP R-3 AND GROUP R-3.1 OCCUPANCIES PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN

*Note: The effective date of these standards shall be March 1, 2012 or ninety (90) days after the corresponding maps are completed and become readily available to the general public, whichever is the later date.*

### SECTION K101 SCOPE

**K101.1 General.** The provisions of this section shall apply to new construction, changes of use and to substantial improvement and restoration of substantial damage as defined in Section 1612, of Group R-3 and R-3.1 Occupancies in areas protected by the facilities of the Central Valley Flood Protection Plan where flood levels are anticipated to exceed three feet for the 200-year flood event. Except as specifically required by this section, buildings and structures shall meet applicable provisions of this code.

**Exception:** Changes of use of Group R-3 to Group R-3.1 Occupancies, including any substantial improvement done under the same permit.

**K101.1.1 Construction documents.** If the land on which the proposed work is to be constructed is located in an area protected by the facilities of the Central Valley Flood Protection Plan, the construction documents shall include the WSEL200 and the elevation(s) of the floor(s), and, as applicable, the elevation(s) and slopes of roofs, of the building or structure.

### SECTION K102 DEFINITIONS

**K102.1 General.** The following words and terms shall, for the purposes of this section, have the meanings shown.

**AREAS PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN WHERE FLOOD LEVELS ARE ANTICIPATED TO EXCEED THREE FEET FOR THE 200-YEAR FLOOD EVENT.** Geographical areas identified by the state as "Areas Protected by the Facilities of the Central Valley Flood Protection Plan where Flood Levels are Anticipated to Exceed Three Feet for the 200-Year Flood Event" in accordance with Health and Safety Code Section 50465. Published data from the California Department of Water Resources can be obtained online at the following website: [www.water.ca.gov/ BuildingCodes](http://www.water.ca.gov/BuildingCodes).

**Note:** The facilities of the Central Valley Flood Protection Plan are identified in the following counties: Butte, Colusa, Fresno, Glenn, Lake, Madera, Merced, Plumas, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Yolo and Yuba. Determination of additional facilities is ongoing.

**CENTRAL VALLEY.** Any lands in the bed or along or near the banks of the Sacramento River and the San Joaquin River, and any of their tributaries or connected therewith, or upon any land adjacent thereto, or within any of the overflow basins thereof, or upon any land susceptible to overflow therefrom. The following counties and the incorporated municipalities within these counties, in whole or in part, are in the Central Valley: Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Benito, San Joaquin, Shasta, Sierra, Siskiyou, Solano, Stanislaus, Sutter, Tehama, Tuolumne, Yolo and Yuba. A map that delineates the Central Valley can be obtained online at the following website: [www.water.ca.gov/BuildingCodes](http://www.water.ca.gov/BuildingCodes).

**EVACUATION LOCATION.** A location no less than one (1) foot (0.30 meter) above the WSEL200 where occupants are expected to congregate pending evacuation and from which occupants may be evacuated during conditions of flooding, such as a space within the building that has an exit door or operable window; a deck, balcony, porch, rooftop platform or rooftop area, or combinations thereof.

**FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN.** The facilities referenced herein include the facilities of State Plan of Flood Control and other flood management facilities in the Central Valley evaluated under the Central Valley Flood Protection Plan, which will be completed in 2012 and updated every 5 years thereafter. The facilities of State Plan of Flood Control include the state and federal flood control works (levees, weirs, channels and other features) of the Sacramento River Flood Control Project described in Water Code Section 8350, and flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Water Code section 12648) of Chapter 2 of Part 6 of Division 6 for which the Central Valley Flood Protection Board or the Department of Water Resources has provided the assurances of nonfederal cooperation to the United States, and those facilities identified in Water Code Section 8361.

**ROUTE TO THE EVACUATION LOCATION.** The path through and along which occupants move from the habitable areas of a building or structure that are below the WSEL200 to the evacuation location.

**WSEL200.** The water surface elevation (WSEL) of the 200-year flood event that is identified by the state when it identifies areas that receive protection from the facilities of the Central Valley Flood Protection Plan.



### SECTION K103 STRUCTURAL STABILITY

**K103.1 General.** Portions of buildings and structures supporting evacuation locations shall be designed, constructed, connected and anchored to resist flotation, collapse or permanent lateral movement resulting from the hydrostatic loads anticipated during conditions of flooding anticipated for the 200-year flood event.

**K103.2 Determination of loads.** Hydrostatic loads, based on the depth of water determined by the WSEL200, shall be determined in accordance with Chapter 5 of ASCE 7. Reduction of hydrostatic loads may be accomplished by allowing for the automatic entry and exit of floodwaters to minimize unbalanced loads. Such means shall be designed by a registered design professional and include, but are not limited to, openings, valves, and panels designed to yield under load.

**Exception:** When two flood vents are installed on opposite sides of the building or structure, one on each side, that comply with Figure K103.1.

### SECTION K104 EVACUATION LOCATIONS

**K104.1 General.** An evacuation location and a route to the evacuation location shall be provided for Group R-3 and R-3.1 Occupancies.

**K104.2 Route to evacuation location.** A route shall be allowed through any number of intervening rooms or spaces. Doors along the route shall be openable without the use of a key or lock, special knowledge or effort.

**Exception:** Doors in individual dwelling or sleeping units having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.

**K104.2.1 Group R-3.1 Occupancies.** The route to an evacuation location shall meet the accessibility requirements of Chapter 11A or 11B as applicable.

**K104.3 Minimum size requirements.** Evacuation locations shall provide a minimum gross floor area of 7 square feet (0.65 m<sup>2</sup>) per occupant, based on the occupant load of the portions of the building that are below the WSEL200. The area provided shall be adequate to accommodate the occupant load of the upper levels as well as the anticipated occupant load from the area below the WSEL200.

### SECTION K105 SPACE WITHIN THE BUILDING

**K105.1 General.** If the evacuation location is a space within a building, the evacuation location shall be provided with a means for occupants to be evacuated out of the building specified in Sections K105.1.1, K105.1.2 or K105.1.3.

**K105.1.1 Windows, minimum size and dimensions.** A minimum of one window shall be provided that meets the minimum size, minimum dimensions and operational constraints of Section 1026. The number of such windows shall be appropriate for the occupancy or occupancies of the portions of the building that are below the WSEL200.

**Note:** It is the intent of this section that windows are of sufficient number, sizes and dimensions to reasonably accommodate the needs and limitations of the occupants of the building. Reasonable judgment in the application of this requirement must be exercised by the building official.

**K105.1.2 Exterior doors to decks, balconies and porches.** Exterior doors to decks, balconies and porches shall be sized in accordance with Section 1008.

**Exception:** In Group R-3.1 Occupancies that are subject to the requirements of Chapters 11A or 11B, doors to decks, balconies or porches shall comply with Section 1132A.1.

**K105.1.3 Means of escape to rooftops from spaces within a building.** The means of escape to rooftops shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

**Exception:** In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such accessibility requirements shall apply to the means of escape to rooftops.

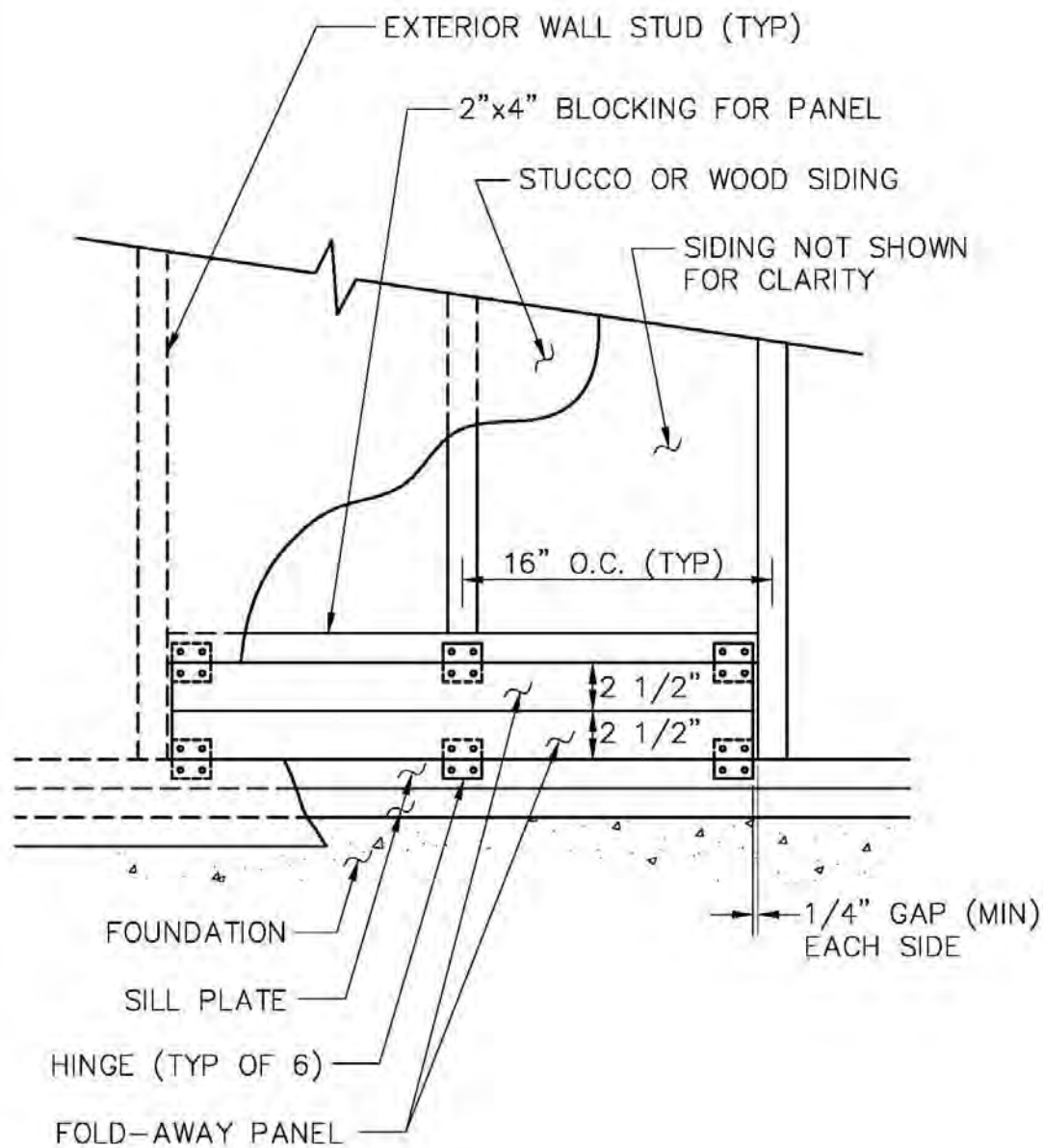
### SECTION K106 DECKS AND BALCONIES THAT ARE EVACUATION LOCATIONS

**K106.1 General.** Decks and balconies that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations. When a deck or balcony used as an evacuation location is not at the same level as a floor within the building, it shall be permitted to be accessed by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

**K106.2 Live load.** Decks and balconies that are evacuation locations shall be designed for the live load required for the occupancy as required in Table 1607.2.

**K106.3 Evacuation route.** Evacuation routes to decks and balconies that are evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

**Exception:** In Group R-3.1 Occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to decks and balconies.



**FIGURE K103.1**

N.T.S.



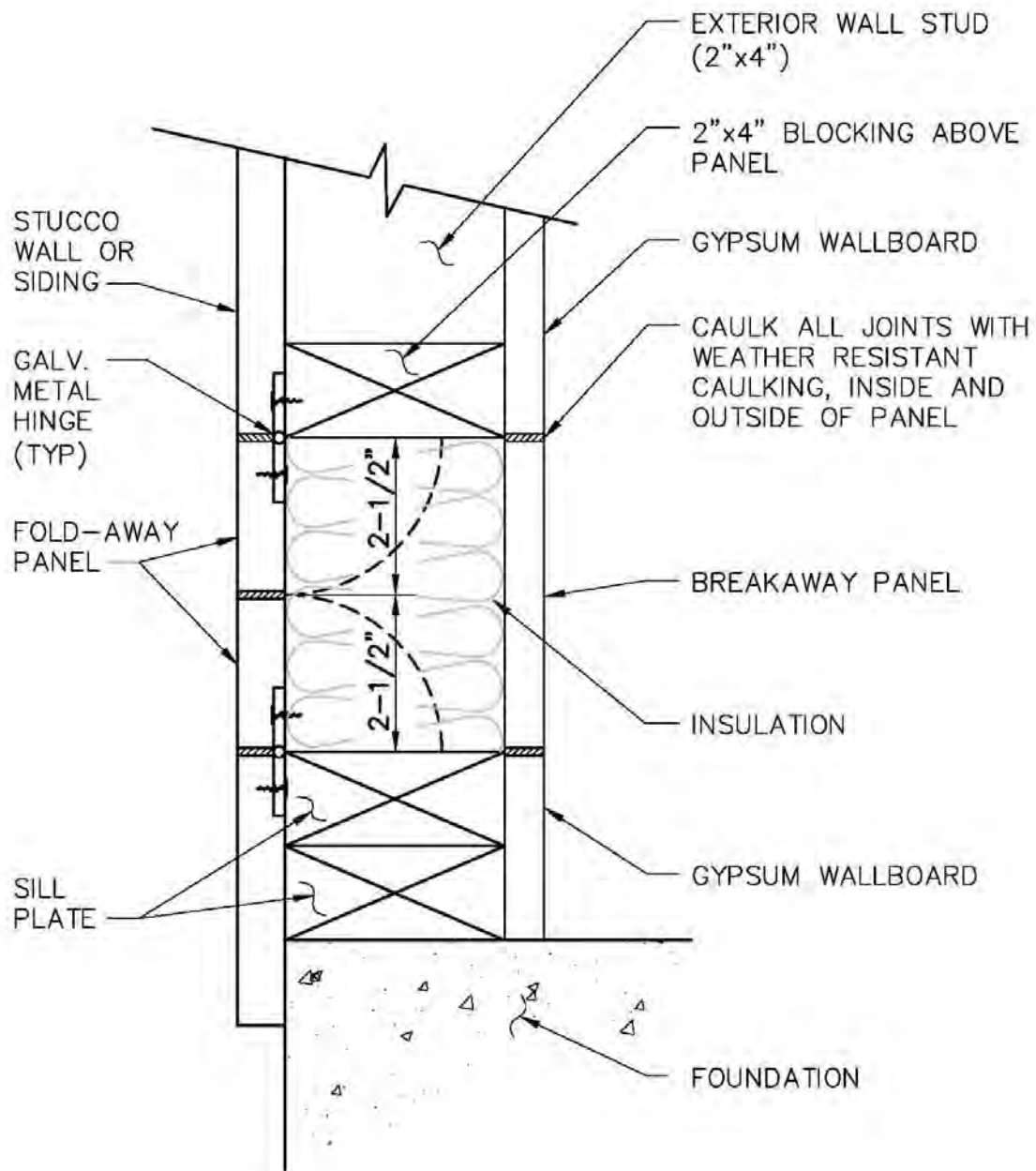


FIGURE K103.1

N.T.S.

## SECTION K107 ROOFTOP EVACUATION LOCATIONS

**K107.1 General.** Rooftop evacuation locations shall be permitted to include rooftop platforms and rooftop areas provided that they are no less than one (1) foot (0.30 meter) above the WSEL200. A minimum horizontal distance of three (3) feet (0.91 meter) shall be provided between the lower edge of the rooftop evacuation location access point and the evacuation location lower perimeter.

**K107.2 Rooftop platforms required.** A rooftop platform shall be provided if the roof covering materials are:

1. Clay tile, concrete tile, slate shingles, wood shingles or wood shakes, and the roof slope is three units vertical in 12 units horizontal (25 percent slope) or greater.
2. Metal roof panels or metal roof shingles, and the roof slope is one unit vertical in 12 units horizontal (8.33 percent slope) or greater.

**K107.3 Roof live loads.** Roof areas that are rooftop evacuation locations and roofs that support rooftop platforms that are evacuation locations shall be designed for the roof live load required for the occupancy as required in Table 1607.2.

**K107.4 Evacuation routes to rooftop evacuation locations.** Evacuation routes to rooftop evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

**Exception:** In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to rooftops.

**K107.5 Perimeter protection.** For Group R-3 and R-3.1 occupancies, the perimeter of rooftop evacuation locations shall be protected by:

1. Guards per Section 1013 if a rooftop platform is provided; or
2. A railing that is 12 inches (305 mm) in height if a sloped roof is provided.

**K107.6 Utility/equipment buffer zone.** A separation of 48 inches shall be provided between a rooftop evacuation location and any mechanical equipment, photovoltaic system, utility service drop or other utility line. Electrical service lines shall not pass over evacuation locations.

## SECTION K108 ATTICS THAT ARE EVACUATION LOCATIONS

**K108.1 General.** Attics that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations.

**K108.2 Headroom.** When an attic is used as an evacuation location, the minimum headroom of the required area shall be 30 inches (762 mm) with 50 percent of the required area having a headroom of 60 inches (1524 mm).

**K108.3 Attic flooring.** The required area of the evacuation location shall be solidly sheathed.

**K108.4 Attic live loads.** Attic areas that are used as evacuation locations shall be designed for the floor live load required for the occupancy as required in Table 1607.2.

**K108.5 Evacuation routes to attic evacuation locations.** Evacuation routes to attic evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

**Exception:** In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to attics.

**K108.6 Means of escape from attics.** The means of escape from attics shall comply with Section K105.

## SECTION K109 ALTERNATE MEANS OF PROTECTION

**K109.1 Request for approval of alternate means of protection.** Requests for approval to use an alternative means of protection shall be made in writing to the building official by the owner or the owner's authorized representative. The request shall be accompanied by a full statement of the conditions and sufficient evidence that the proposed alternate means of protection provides reasonable protection to occupants. The building official shall require the owner to obtain a written statement from the applicable emergency management authority regarding plans and processes related to notification of anticipated conditions of flooding, warnings, evacuations and other pertinent conditions relative to the proximity of nearby levees. The building official shall also require the owner to obtain a written statement and findings from the entity that has jurisdiction over the management, maintenance, monitoring and control of flood protection works in the vicinity of the location of the owner's property; such statement shall comment on the viability of the proposed alternate means of protection. The building official may request written statements from the Central Valley Flood Protection Board, the California Department of Water Resources, and the California Emergency Management Agency.

Approval of a request for use of an alternative means of protection made pursuant to these provisions shall be limited to the particular case covered by the request and shall not be construed as establishing any precedent for any future request except in substantially equivalent situations.

**Note:** Contact information for the California Department of Water Resources and the Department's Directory of Flood Officials, which includes levee and reclamation district boundary maps, is available on-line at the following web site: [www.water.ca.gov/BuildingCodes](http://www.water.ca.gov/BuildingCodes). The Department of Water Resources Building Code Project Engineer can be contacted at 916-574-1451. The Central Valley Flood Control Board Chief Engineer can be contacted at 916-574-0609. The California Emergency Management Agency Inland Region Program Manager can be contacted at 916-845-8488.

**K109.2 Appeals.** *When a request for an alternate means of protection has been denied by the building official, the applicant may file a written appeal with the board of appeals. In considering such appeal, the board of appeals may provide additional information to, and request additional written statements from, the Central Valley Flood Protection Board, the California Department of Water Resources, and the California Emergency Management Agency. If such additional written statements are provided, the board of appeals shall consider those statements.*

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### APPENDIX L – EARTHQUAKE RECORDING INSTRUMENTATION

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>									X		X	X								
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				
L101									X		X	X								
L102									X		X	X								
L103									X											



## APPENDIX L

# EARTHQUAKE RECORDING INSTRUMENTATION

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION L101 GENERAL

**L101.1 General.** Every structure located where the 1-second spectral response acceleration,  $S_1$ , in accordance with Section 1613.3 is greater than 0.40 that either 1) exceeds six stories in height with an aggregate floor area of 60,000 square feet (5574 m<sup>2</sup>) or more, or 2) exceeds ten stories in height regardless of floor area, shall be equipped with not less than three approved recording accelerographs. The accelerographs shall be interconnected for common start and common timing.

*[OSHPD 1, 3 & 4] There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent.*

**L101.2 Location.** As a minimum, instruments shall be located at the lowest level, mid-height, and near the top of the structure. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating "MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT" in 1-inch block letters shall be posted in a conspicuous location.

*[OSHPD 1, 3 & 4] A proposal for instrumentation and equipment specifications shall be forwarded to the enforcement agency for review and approval.*

**L101.3 Maintenance.** Maintenance and service of the instrumentation shall be provided by the owner of the structure. Data produced by the instrument shall be made available to the building official on request.

Maintenance and service of the instruments shall be performed annually by an approved testing agency. The owner shall file with the building official a written report from an approved testing agency certifying that each instrument has been serviced and is in proper working condition. This report shall be submitted when the instruments are installed and annually thereafter. Each instrument shall have affixed to it an externally visible tag specifying the date of the last maintenance or service and the printed name and address of the testing agency.

*[OSHPD 1] The owner of the building shall be responsible for the implementation of the instrumentation program. Maintenance of the instrumentation and removal/processing of the records shall be the responsibility of the enforcement agency.*



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## APPENDIX M – TSUNAMI-GENERATED FLOOD HAZARD

(Not adopted by state agencies)

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1/AC	AC	SS	SS/CC	1	2	3	4								
<i>Adopt entire chapter</i>																				
<i>Adopt entire chapter as amended (amended sections listed below)</i>																				
<i>Adopt only those sections that are listed below</i>																				
<i>Chapter / Section</i>																				





## APPENDIX M

# TSUNAMI-GENERATED FLOOD HAZARD

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### SECTION M101 TSUNAMI-GENERATED FLOOD HAZARD

**M101.1 General.** The purpose of this appendix is to provide tsunami regulatory criteria for those communities that have a tsunami hazard and have elected to develop and adopt a map of their tsunami hazard inundation zone.

**M101.2 Definitions.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *California Building Code* for general definitions.

**TSUNAMI HAZARD ZONE.** The area vulnerable to being flooded or inundated by a design event tsunami as identified on a community's Tsunami Hazard Zone Map.

**TSUNAMI HAZARD ZONE MAP.** A map adopted by the community that designates the extent of inundation by a design event tsunami. This map shall be based on the tsunami inundation map which is developed and provided to a community by either the applicable State agency or the National Atmospheric and Oceanic Administration (NOAA) under the National Tsunami Hazard Mitigation Program, but shall be permitted to utilize a different probability or hazard level.

**M101.3 Establishment of Tsunami Hazard Zone.** Where applicable, if a community has adopted a Tsunami Hazard Zone Map, that map shall be used to establish a community's Tsunami Hazard Zone.

**M101.4 Construction within the Tsunami Hazard Zone.** Construction of structures designated Risk Category III and IV as specified under Section 1604.5 shall be prohibited within a Tsunami Hazard Zone.

#### **Exceptions:**

1. A vertical evacuation tsunami refuge shall be permitted to be located in a Tsunami Hazard Zone provided it is constructed in accordance with FEMA P646.
2. Community critical facilities shall be permitted to be located within the Tsunami Hazard Zone when such a location is necessary to fulfill their function, providing suitable structural and emergency evacuation measures have been incorporated.

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# HISTORY NOTE APPENDIX

## California Building Code Title 24, Part 2, California Code of Regulations (CCR)

For prior code history, see the History Note Appendix to the *California Building Code (CRC)*, 2010 Triennial Edition effective January 1, 2011.

1. BSC 03/12, SFM 02/12, OSHPD 03/12 & 04/12, DSA-SS 02/12, HCD 06/12, HCD 08/12, DSA-AC 01/12, BSCC 01/12, CDPH 01/12, SLC 01/12 — Adoption of the 2012 edition of the *International Building Code* published by the International Code Council, for incorporation into the *2013 California Building Code*, CCR Title 24, Part 2 with amendments for State regulated occupancies effective on January 1, 2014.





# **CALIFORNIA** 2013 **HISTORICAL BUILDING** **CODE**

**California Code of Regulations  
Title 24, Part 8**

California Building Standards Commission



Effective Date: January 1, 2014  
(For Errata and Supplements, see History Note Appendix)

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California Code of Regulations, Title 24, Part 8

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## PREFACE

This document is the 8th of 12 parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Historical Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must be filed with the California Building Standards Commission to become effective and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

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2525 Natomas Park Drive, Suite 130  
Sacramento, CA 95833-2936  
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Web Page: [www.bsc.ca.gov](http://www.bsc.ca.gov)

## ACKNOWLEDGEMENTS

The 2013 California Building Standards Code (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, the Division of State Architect, the Office of the State Fire Marshal, the Office of Statewide Health Planning and Development, the California Energy Commission, the California Department of Public Health, the California State Lands Commission, the Board of State and Community Corrections, and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

*Governor Edmund G. Brown Jr.*

*Members of the California Building Standards Commission*

*Secretary Anna Caballero – Chair*

*James Barthman – Vice-Chair*

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*Michael L. Nearman – Deputy Executive Director*

For questions on California state agency amendments, please refer to the contact list on the following page.



## PART 8 CONTAINS ALTERNATIVE REGULATIONS FOR QUALIFIED HISTORICAL BUILDINGS

The *California Historical Building Code* (CHBC) is unique among state regulations. The authoring of the original CHBC required state agencies promulgating regulations for building construction to work in harmony with representatives of other design and construction disciplines. The result was a totally new approach to building codes for historical structures, which maintains currently acceptable life–safety standards.

These regulations are also unique in that they are performance oriented rather than prescriptive. The provisions of the CHBC are to be applied by the enforcing authority of every city, county, city and county, or state agency in permitting repairs, alterations and additions necessary for the preservation, rehabilitation, relocation, related construction, change of use or continued use of a qualified historical building.

The authority for use of the CHBC is vested in Sections 18950 through 18961 of the Health and Safety Code. Section 18954 states, “The building department of every city or county shall apply the provisions of alternative building standards and building regulations adopted by the CHBC Board pursuant to Section 18959.5 in permitting repairs, alterations and additions necessary for the preservation, restoration, rehabilitation, moving or continued use of an historical building or structure. A state agency shall apply the alternative building regulations adopted by the CHBC Board pursuant to Section 18959.5 in

permitting repairs, alterations and additions necessary for the preservation, restoration, rehabilitation, moving or continued use of an historical building or structure.”

However, be aware that in order to use the CHBC, the structure under consideration must be qualified by being designated as an historical building or structure. Section 18955 states, “For the purposes of this part, a qualified historical building or structure is any structure or collection of structures, and their associated sites deemed of importance to the history, architecture or culture of an area by an appropriate local or state governmental jurisdiction. This shall include structures on existing or future national, state or local historical registers or official inventories, such as the National Register of Historic Places, State Historical Landmarks, State Points of Historical Interest, and city or county registers or inventories of historical or architecturally significant sites, places, historic districts or landmarks.”

The regulations of the CHBC have the same authority as state law and are to be considered as such. Liability is the same as for prevailing law.

The intent of the CHBC is to save California’s architectural heritage by recognizing the unique construction problems inherent in historical buildings and by providing a code to deal with these problems.

## HISTORICAL PREFACE

The background of the *California Historical Building Code* can be traced to December 1973, when the State Department of Parks and Recreation published the California History Plan, Volume I, in which Recommendation No. 11 was proposed by the then California Landmarks Advisory Committee (later to become The State Historical Resources Commission). This proposal expressed a need for a new building code to meet the intent of protecting the public health and safety and also retain “enough flexibility to allow restoration of a Historic feature while still retaining its Historic integrity.” No. 11 of this History Plan supported this need by stating that “. . . restoration . . . is frequently made difficult by unnecessarily rigid interpretation of building . . . codes.”

In March of 1974, the Landmarks Committee by resolution recommended that the Director of the State Department of Parks and Recreation and the State Architect initiate a study to develop this needed code. These two officials accepted this concept and jointly called a statewide meeting in Sacramento on May 14th of that year. Attending were representatives from both the public and private sectors, such as members of the building industry, design professions, local and state building officials, and others interested in this problem.

Out of this open conference, a steering committee was formed to explore in depth the ways and means of implementing the new historical building code concept. This ad hoc committee was chaired by a representative from the California Council, American Institute of Architects and composed of a comprehensive cross section of the professional organizations and government agencies concerned with design and code enforcement.

Meetings began late in 1974 and continued into early 1975. By April of that year, a legislative subcommittee of the ad hoc group drafted a sample bill for the proposed code and requested that it be carried by Senator James R. Mills, President Pro Tem-

pore of the Senate. After further development and refinement, the enacting legislation to create the authority for the code and an advisory board to prepare regulations to implement it (SB 927, Mills) was supported by both the legislature and the public. It was signed by the governor in September 1975, and became effective January 1, 1976.

The members of the advisory board, which were required by law to include local and state building officials, individuals from the building industry and design professions, as well as representatives from city and county governments, were appointed and held their first session in Sacramento, February 24, 1976. This Board's duties included the preparation of code regulations and the review of specific historic building cases, when officially requested by governing bodies.

Several of the Board's members were a part of the original ad hoc steering committee and thus provided a continuity and smooth transition from the inception of the code's philosophy to its pragmatic implementation in these performance-oriented regulations.

The first comprehensive regulations were codified in August and October 1979, after years of careful deliberation. Those regulations allowed all jurisdictions to utilize them at their discretion in replacing or modifying details of prevailing prescriptive codes.

Changes made in law in 1984 and 1991, and to the code, make the application of the *California Historical Building Code* statutes and regulations applicable for all agencies and at the discretion of the owner for local jurisdictions when dealing with qualified historical buildings.

These current performance regulations were adopted by the Board on June 23, 1998, and approved by the California Building Standards Commission on December 12, 2013.



# CALIFORNIA CODE OF REGULATIONS, TITLE 24

## California Agency Information Contact List

### Board of State and Community Corrections

www.csa.ca.gov . . . . . (916) 445-5073  
Local Adult Jail Standards  
Local Juvenile Facility Standards

### California Building Standards Commission

www.bsc.ca.gov . . . . . (916) 263-0916

### California Energy Commission

www.enregy.ca.gov . . . . . **Energy Hotline** (800) 772-3300  
Building Efficiency Standards  
Appliance Efficiency Standards  
Compliance Manual/Forms

### California State Lands Commission

www.slc.ca.gov . . . . . (562) 499-6312  
Marine Oil Terminals

### California State Library

www.library.ca.gov . . . . . (916) 654-0266

### Department of Consumer Affairs:

#### Acupuncture Board

www.acupuncture.ca.gov . . . . . (916) 515-5200  
Office Standards

#### Board of Pharmacy

www.pharmacy.ca.gov . . . . . (916) 574-7900  
Pharmacy Standards

#### Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov . . . . . (916) 952-5210  
Barber and Beauty Shop,  
and College Standards

#### Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation

www.bearhfti.ca.gov . . . . . (916) 999-2041  
Insulation Testing Standards

#### Structural Pest Control Board

www.pestboard.ca.gov . . . . . (800) 737-8188  
Structural Standards

#### Veterinary Medical Board

www.vmb.ca.gov . . . . . (916) 263-2610  
Veterinary Hospital Standards

### Department of Food and Agriculture

www.cdffa.ca.gov  
Meat & Poultry Packing Plant Standards (916) 654-0509  
Dairy Standards (916) 654-0773

### Department of Housing and Community Development

www.hcd.ca.gov . . . . . (916) 445-9471  
Residential- Hotels, Motels, Apartments,  
Single-Family Dwellings; and  
Permanent Structures in Mobilehome &  
Special Occupancy Parks  
(916) 445-3338  
Factory-Built Housing, Manufactured Housing &  
Commercial Modular  
Mobilehome- Permits & Inspections  
Northern Region—(916) 255-2501  
Southern Region—(951) 782-4420  
(916) 445-9471  
Employee Housing Standards

### Department of Public Health

www.dph.ca.gov . . . . . (916) 449-5661  
Organized Camps Standards  
Public Swimming Pools Standards

### Department of Water Resources

www.dwr.ca.gov . . . . . (916) 651-9676  
Gray Water Information

### Division of the State Architect

www.dgs.ca.gov/dsa . . . . . (916) 445-8100

#### Access Compliance

#### Structural Safety

Public Schools Standards  
Essential Services Building Standards  
Community College Standards

#### State Historical Building Safety Board

Alternative Building Standards

### Office of Statewide Health Planning and Development

www.oshpd.ca.gov . . . . . (916) 654-3139  
Hospital Standards  
Skilled Nursing Facility Standards &  
Clinic Standards

Permits (916) 654-3362

### Office of the State Fire Marshal

osfm.fire.ca.gov . . . . . (916) 445-8200  
Code Development and Analysis  
Fire Safety Standards  
Fireplace Standards  
Day Care Centers Standards  
Exit Standards

# HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

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|| This symbol indicates that a change has been made.

> This symbol indicates deletion of language.

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## CHAPTER 8-1

# ADMINISTRATION

Note: The *California Historical Building Code*, Part 8 of Title 24, governs for all qualified historical buildings or properties in the State of California.

### SECTION 8-101

#### TITLE, PURPOSE AND INTENT

**8-101.1 Title.** These regulations shall be known as the *California Historical Building Code* and will be referred to herein as “the CHBC.”

**8-101.2 Purpose.** The purpose of the CHBC is to provide regulations for the preservation, restoration, rehabilitation, relocation or reconstruction of buildings or properties designated as qualified historical buildings or properties (Chapter 8-2). The CHBC is intended to provide solutions for the preservation of qualified historical buildings or properties, to promote sustainability, to provide access for persons with disabilities, to provide a cost-effective approach to preservation, and to provide for the reasonable safety of the occupants or users. The CHBC requires enforcing agencies to accept solutions that are reasonably equivalent to the regular code (as defined in Chapter 8-2) when dealing with qualified historical buildings or properties.

**8-101.3 Intent.** The intent of the CHBC is to facilitate the preservation and continuing use of qualified historical buildings or properties while providing reasonable safety for the building occupants and access for persons with disabilities.

### SECTION 8-102

#### APPLICATION

**8-102.1 Application.** The CHBC is applicable to all issues regarding code compliance for qualified historical buildings or properties. The CHBC may be used in conjunction with the regular code to provide solutions to facilitate the preservation of qualified historical buildings or properties. The CHBC shall be used by any agency with jurisdiction and whenever compliance with the code is required for qualified historical buildings or properties.

1. The state or local enforcing agency shall apply the provisions of the CHBC in permitting repairs, alterations and additions necessary for the preservation, restoration, reconstruction, rehabilitation, relocation or continued use of a qualified historical building or property when so elected by the private property owner.
2. **State agencies.** All state agencies shall apply the provisions of the CHBC in permitting repairs, alterations and additions necessary for the preservation, restoration, rehabilitation, safety, relocation, reconstruction or continued use of qualified historical buildings or properties.

**8-102.1.1 Additions, alterations and repairs.** It is the intent of the CHBC to allow nonhistorical expansion or addition to a qualified historical building or property, pro-

vided nonhistorical additions shall conform to the requirements of the regular code. See Chapter 8-2.

**8-102.1.2 Relocation.** Relocated qualified historical buildings or properties shall be sited to comply with the regular code or with the solutions listed in the CHBC. Nonhistorical new construction related to relocation shall comply with the regular code. Reconstruction and restoration related to relocation is permitted to comply with the provisions in the CHBC.

**8-102.1.3 Change of occupancy.** For change of use or occupancy, see Chapter 8-3, Use and Occupancy.

**8-102.1.4 Continued use.** Qualified historical buildings or properties may have their existing use or occupancy continued if such use or occupancy conformed to the code or to the standards of construction in effect at the time of construction, and such use or occupancy does not constitute a distinct hazard to life safety as defined in the CHBC.

**8-102.1.5 Unsafe buildings or properties.** When a qualified historical building or property is determined to be unsafe as defined in the regular code, the requirements of the CHBC are applicable to the work necessary to correct the unsafe conditions. Work to remediate the buildings or properties need only address the correction of the unsafe conditions, and it shall not be required to bring the entire qualified historical building or property into compliance with regular code.

**8-102.1.6 Additional work.** Qualified historical buildings or properties shall not be subject to additional work required by the regular code, regulation or ordinance beyond that required to complete the work undertaken. Certain exceptions for accessibility and for distinct hazards exist by mandate and may require specific action, within the parameters of the CHBC.

### SECTION 8-103

#### ORGANIZATION AND ENFORCEMENT

**8-103.1 Authority.** The state or local enforcing agency, pursuant to authority provided under Section 18954 of the Health and Safety Code, shall administer and enforce the provisions of the CHBC in permitting repairs, alterations and additions necessary for the preservation, restoration, reconstruction, rehabilitation, relocation or continued use of a qualified historical building or property.

**8-103.2 State enforcement.** All state agencies pursuant to authority provided under Section 18954 and Section 18961 of the Health and Safety Code shall administer and enforce the CHBC with respect to qualified historical buildings or properties under their respective jurisdiction.



**8-103.3 Liability.** Prevailing law regarding immunity of building officials is unaffected by the use and enforcement of the CHBC.

## SECTION 8-104 REVIEW AND APPEALS

**8-104.1 State Historical Building Safety Board (SHBSB).** In order to provide for interpretation of the provisions of the CHBC and to hear appeals, the SHBSB shall act as an appeal and review body to state and local agencies or any affected party.

**8-104.2 SHBSB review.** When a proposed design, material or method of construction is being considered by the enforcing agency, the agency chief, the building official or the local board of appeals may file a written request for opinion to the SHBSB for its consideration, advice or findings. In considering such request, the SHBSB may seek the advice of other appropriate private or public boards, individuals, or state or local agencies. The SHBSB shall, after considering all of the facts presented, including any recommendation of other appropriate boards, agencies or other parties, determine if, for the purpose intended, the proposal is reasonably equivalent to that allowed by these regulations in proposed design, material or method of construction, and it shall transmit such findings and its decision to the enforcing agency for its application. The Board may recover the costs of such reviews and shall report the decision in printed form, copied to the California Building Standards Commission.

**8-104.2.1 State agencies.** All state agencies with ownership of, or that act on behalf of state agency owners of, qualified historical buildings or properties, shall consult and obtain SHBSB review prior to taking action or making decisions or appeals that affect qualified historical buildings or properties, per Section 18961 of the Health and Safety Code.

**8-104.2.2 Imminent threat.** Where an emergency is declared and a qualified historical building or property is declared an imminent threat to life and safety, the state agency assessing such a threat shall consult with the SHBSB before any demolition is undertaken, per Section 18961 of the Health and Safety Code.

**8-104.3 SHBC appeals.** If any local agency administering and enforcing the CHBC or any person adversely affected by any regulation, rule, omission, interpretation, decision or practice of the agency enforcing the CHBC wishes to appeal the issue for resolution to the SHBSB, either of these parties may appeal directly to the Board. The Board may accept the appeal only if it determines that issues involved are of statewide significance. The Board may recover the costs of such reviews and shall make available copies of decisions in printed form at cost, copied to the California Building Standards Commission.

**8-104.4 Local agency fees.** Local agencies, when actively involved in the appeal, may also charge affected persons reasonable fees not to exceed the cost of obtaining reviews and appeals from the Board.

## SECTION 8-105 CONSTRUCTION METHODS AND MATERIALS

**8-105.1 Repairs.** Repairs to any portion of a qualified historical building or property may be made in-kind with historical materials and the use of original or existing historical methods of construction, subject to conditions of the CHBC. (See Chapter 8-8.)

**8-105.2 Solutions to the *California Historical Building Code*.** Solutions provided in the CHBC, or any other acceptable regulation or methodology of design or construction and used in whole or in part, with the regular code, or with any combination of the regular code and the CHBC, shall be allowed. The CHBC does not preclude the use of any proposed alternative or method of design or construction not specifically prescribed or otherwise allowed by these regulations. Any alternative may be submitted for evaluation to the appropriate enforcing agency for review and acceptance. The enforcing agency may request that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding such solutions. Any alternative offered in lieu of that prescribed or allowed in the CHBC shall be reasonably equivalent in quality, strength, effectiveness, durability and safety to that of the CHBC.

## SECTION 8-106 SHBSB RULINGS

**8-106.1 General.** Rulings of the SHBSB (i.e., formal appeals, case decisions, code interpretations and administrative resolutions, etc.) that are issues of statewide application are required to be submitted to the California Building Standards Commission in printed form. These rulings may be used to provide guidance for similar cases or issues.

## CHAPTER 8-2

# DEFINITIONS

### SECTION 8-201 DEFINITIONS

For the purpose of the CHBC, certain terms and phrases, words and their derivatives shall be construed as specified in this chapter. Additional definitions and/or terms may appear in the various other chapters relative to terms or phrases primarily applicable thereto. Any reference to “authority having jurisdiction” does not necessarily preclude the appellate process of Section 8-104.3.

**ADDITION.** A nonhistorical extension or increase in floor area or height of a building or property.

**ALTERATION.** A modification to a qualified historical building or property that affects the usability of the building or property, or part thereof. Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historical restoration, changes or rearrangement of the structural parts or elements, and changes or rearrangements in the plan configuration of walls and full-height partitions.

**BUILDING STANDARD.** Any guideline, regulation or code that may be applied to a qualified historical building or property.

**CHARACTER-DEFINING FEATURE.** Those visual aspects and physical elements that comprise the appearance of a historical building or property, and that are significant to its historical, architectural and cultural values, including the overall shape of the historical building or property, its materials, craftsmanship, decorative details, interior spaces and features, as well as the various aspects of its site and environment.

**CULTURAL RESOURCE.** Building, site, property, object or district evaluated as having significance in prehistory or history.

**DISTINCT HAZARD.** Any clear and evident condition that exists as an immediate danger to the safety of the occupants or public right of way. Conditions that do not meet the requirements of current regular codes and ordinances do *not*, of themselves, constitute a distinct hazard. Section 8-104.3, SHBC appeals, remains applicable.

**ENFORCING AGENCY,** Authority Having Jurisdiction, Local Agency with Jurisdiction. An entity with the responsibility for regulating, enforcing, reviewing or otherwise that exerts control of or administration over the process of gaining permits, approvals, decisions, variances, appeals for qualified historical buildings or properties.

**EXIT LADDER DEVICE.** An exit ladder device is a permanently installed, fixed, folding, retractable or hinged ladder intended for use as a means of emergency egress from areas of the second or third stories. Unless approved specifically for a longer length, the ladder shall be limited to 25 feet (7620 mm) in length. Exit ladders are permitted where the area served by the ladder has an occupant load less than 10 persons.

**FIRE HAZARD.** Any condition which increases or may contribute to an increase in the hazard or menace of fire to a greater degree than customarily recognized by the authority having jurisdiction, or any condition or act which could obstruct, delay, hinder or interfere with the operations of firefighting personnel or the egress of occupants in the event of fire. Section 8-104.3, SHBC appeals, remains applicable.

**HISTORICAL FABRIC OR MATERIALS.** Original and later-added historically significant construction materials, architectural finishes or elements in a particular pattern or configuration which form a qualified historical property, as determined by the authority having jurisdiction.

**HISTORICAL SIGNIFICANCE.** Importance for which a property has been evaluated and found to be historical, as determined by the authority having jurisdiction.

**IMMINENT THREAT.** Any condition within or affecting a qualified historical building or property which, in the opinion of the authority having jurisdiction, would qualify a building or property as dangerous to the extent that the life, health, property or safety of the public, its occupants or those performing necessary repair, stabilization or shoring work are in immediate peril due to conditions affecting the building or property. Potential hazards to persons using, or improvements within, the right-of-way may not be construed to be “imminent threats” solely for that reason if the hazard can be mitigated by shoring, stabilization, barricades or temporary fences.

**INTEGRITY.** Authenticity of a building or property’s historical identity, evidenced by the survival of physical characteristics that existed during the property’s historical or prehistorical period of significance.

**LIFE-SAFETY EVALUATION.** An evaluation of the life-safety hazards of a qualified historical building or property based on procedures similar to those contained in NFPA 909, *Standard for the Protection of Cultural Resources, Appendix B, Fire Risk Assessment in Heritage Premises*.

**LIFE SAFETY HAZARD.** See Distinct Hazard.

**PERIOD OF SIGNIFICANCE.** The period of time when a qualified historical building or property was associated with important events, activities or persons, or attained the characteristics for its listing or registration.

**PRESERVATION.** The act or process of applying measures necessary to sustain the existing form, integrity and materials of a qualified historical building or property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-related work to make properties functional is appropriate within a preservation project.

## DEFINITIONS

### **QUALIFIED HISTORICAL BUILDING OR PROPERTY.**

As defined in Health and Safety Code Section 18955 as “Qualified Historical Building or Property.” Any building, site, object, place, location, district or collection of structures, and their associated sites, deemed of importance to the history, architecture or culture of an area by an appropriate local, state or federal governmental jurisdiction. This shall include historical buildings or properties on, or determined eligible for, national, state or local historical registers or inventories, such as the National Register of Historic Places, California Register of Historical Resources, State Historical Landmarks, State Points of Historical Interest, and city or county registers, inventories or surveys of historical or architecturally significant sites, places or landmarks.

**RECONSTRUCTION.** The act or process of depicting, by means of new construction, the form, features and detailing of a nonsurviving site, landscape, building, property or object for the purpose of replicating its appearance at a specific period of time.

**REGULAR CODE.** The adopted regulations that govern the design and construction or alteration of nonhistorical buildings and properties within the jurisdiction of the enforcing agency.

**REHABILITATION.** The act or process of making possible a compatible use for qualified historical building or property through repair, alterations and additions while preserving those portions or features which convey its qualified historical, cultural or architectural values.

**RELOCATION.** The act or process of moving any qualified historical building or property or a portion of a qualified historical building or property to a new site, or a different location on the same site.

**REPAIR.** Renewal, reconstruction or renovation of any portion of an existing property, site or building for the purpose of its continued use.

**RESTORATION.** The act or process of accurately depicting the form, features and character of a qualified building or property as it appeared at a particular period of time by the means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.

**STRUCTURE.** That which is built or constructed, an edifice or a building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

**TREATMENT.** An act of work to carry out preservation, restoration, stabilization, rehabilitation or reconstruction.

## CHAPTER 8-3

# USE AND OCCUPANCY

### SECTION 8-301 PURPOSE AND SCOPE

**8-301.1 Purpose.** The purpose of the CHBC is to provide regulations for the determination of occupancy classifications and conditions of use for qualified historical buildings or properties.

**8-301.2 Scope.** Every qualified historical building or property for which a permit or approval has been requested shall be classified prior to permit issuance according to its use or the character of its occupancy in accordance with the regular code and applicable provisions of this chapter.

### SECTION 8-302 GENERAL

**8-302.1 Existing use.** The use or character of occupancy of a qualified historical building or property, or portion thereof, shall be permitted to continue in use regardless of any period of time in which it may have remained unoccupied or in other uses, provided such building or property otherwise conforms to all applicable requirements of the CHBC.

**8-302.2 Change in occupancy.** The use or character of the occupancy of a qualified historical building or property may be changed from or returned to its historical use or character, provided the qualified historical building or property conforms to the requirements applicable to the new use or character of occupancy as set forth in the CHBC. Such change in occupancy shall not mandate conformance with new construction requirements as set forth in regular code.

**8-302.3 Occupancy separations.** Required occupancy separations of more than one hour may be reduced to one-hour fire-resistive construction with all openings protected by not less than three-fourths-hour fire-resistive assemblies of the self-closing or automatic-closing type when the building is provided with an automatic sprinkler system throughout the entire building in accordance with Section 8-410.4. Doors equipped with automatic-closing devices shall be of a type which will function upon activation of a device which responds to products of combustion other than heat.

Required occupancy separations of one hour may be omitted when the building is provided with an automatic sprinkler system throughout.

**8-302.4 Maximum floor area.** Regardless of the use or character of occupancy, the area of a one-story qualified historical building or property may have, but shall not exceed, a floor area of 15,000 square feet (1393.5 m<sup>2</sup>) unless such an increase is otherwise permitted in regular code. Multistory qualified historical buildings (including basements and cellars) shall be in accordance with regular code requirements.

**Exception:** Historical buildings may be unlimited in floor area without fire-resistive area separation walls:

1. When provided with an automatic sprinkler, or
2. Residential occupancies of two stories or less when provided with a complete fire alarm and annunciation system and where the exiting system conforms to regular code.

**8-302.5 Maximum height.** The maximum height and number of stories of a qualified historical building or property shall not be limited because of construction type, provided such height or number of stories does not exceed that of its historical design.

**8-302.5.1 High-rise buildings.** Occupancies B, F-1, F-2 or S in high-rise buildings with floors located more than 75 feet above the lowest floor level having building access may be permitted with only the stories over 75 feet provided with an automatic fire sprinkler system if:

1. The building construction type and the exits conform to regular code, and
2. A complete building fire alarm and annunciation system is installed, and
3. A fire barrier is provided between the sprinklered and nonsprinklered floors.

**8-302.6 Fire-resistive construction.** See Chapter 8-4.

**8-302.7 Light and ventilation.** Existing provisions for light and ventilation which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain. See Section 8-303.6 for residential requirements. See Section 8-503 for Escape or Rescue Windows and Doors.

### SECTION 8-303 RESIDENTIAL OCCUPANCIES

**8-303.1 Purpose.** The purpose of this section is to provide regulations for those buildings designated as qualified historical buildings or properties and classified as occupancies. The CHBC requires enforcing agencies to accept any reasonably equivalent to the regular code when dealing with qualified historical buildings and properties.

**8-303.2 Intent.** The intent of the CHBC is to preserve the integrity of qualified historical buildings and properties while maintaining a reasonable degree of protection of life, health and safety for the occupants.

**8-303.3 Application and scope.** The provisions of this section shall apply to all qualified historical buildings used for human habitation. Those dwelling units intended only for display, or public use with no residential use involved, need not comply with the requirements of this section.

**8-303.4 Fire escapes.** See Chapter 8-5.

**8-303.5 Room dimensions.** Rooms used for sleeping purposes may contain a minimum of 50 square feet (4.6 m<sup>2</sup>) floor area, provided there is maintained an average ceiling height of 7 feet (2134 mm). Other habitable rooms need only be of adequate size to be functional for the purpose intended.

**8-303.6 Light and ventilation.** Windows in habitable rooms shall have an area of 6 percent of the floor area, or 6 square feet (0.56 m<sup>2</sup>), whichever is greater. Windows in sleeping rooms shall be openable (see Section 8-503). Residential occupancies need not be provided with electrical lighting.

**8-303.7 Alteration and repair.** The alteration and repair of qualified historical buildings or properties may permit the replacement, retention and extension of original materials and the continued use of original methods of construction, provided a life-safety hazard is not created or continued. Alterations and repairs shall be consistent with the CHBC.

The amount of alterations and repairs is not limited, provided there is no nonhistorical increase in floor area, volume or size of the building or property.

**8-303.8 Exiting.** See Chapter 8-5.



## CHAPTER 8-4

# FIRE PROTECTION

### SECTION 8-401 PURPOSE, INTENT AND SCOPE

**8-401.1 Purpose.** The purpose of this chapter is to provide for fire protection of qualified historical buildings or properties. The CHBC requires enforcing agencies to accept any reasonably equivalent to the regular code when dealing with qualified historical buildings or properties.

**8-401.2 Intent.** The intent of the CHBC is to preserve the integrity of qualified historical buildings or properties while maintaining a reasonable degree of fire protection based primarily on the life safety of the occupants and firefighting personnel.

**8-401.3 Scope.** This chapter shall apply when required by the provisions of Section 8-102.

### SECTION 8-402 FIRE-RESISTIVE CONSTRUCTION

**8-402.1 Exterior wall construction.** The fire-resistance requirement for existing exterior walls and existing opening protection may be satisfied when an automatic sprinkler system designed for exposure protection is installed per the CHBC. The automatic sprinklers may be installed on the exterior with at least one sprinkler located over each opening required to be protected. Additional sprinklers shall also be distributed along combustible walls under the roof lines that do not meet the fire-resistive requirement due to relationship to property lines as required by regular code. Such sprinkler systems may be connected to the domestic water supply on the supply-main side of the building shut-off valve. A shut-off valve may be installed for the sprinkler system, provided it is locked in an open position.

**8-402.2 One-hour construction.** Upgrading an existing qualified historical building or property to one-hour fire-resistive construction and one-hour fire-resistive corridors shall not be required regardless of construction or occupancy when one of the following is provided:

1. An automatic sprinkler system throughout. See Section 8-410.2 for automatic sprinkler systems.
2. An approved life-safety evaluation.
3. Other alternative measures as approved by the enforcing agency.

**8-402.3 Openings in fire-rated systems.** Historical glazing materials and solid wood unrated doors in interior walls required to have one-hour fire rating may be approved when operable windows and doors are provided with appropriate smoke seals and when the area affected is provided with an automatic sprinkler system. See Section 8-410 for automatic sprinkler systems.

### SECTION 8-403 INTERIOR FINISH MATERIALS

New nonhistorical interior wall and ceiling finish shall conform to the provisions of the regular code. Existing nonconforming materials used for wood lath and plaster walls, see Section 8-404.

**Exception:** When an automatic sprinkler system is provided throughout the building, existing finishes shall be approved.

### SECTION 8-404 WOOD LATH AND PLASTER

Wood lath and plaster walls may be considered in accordance with codes, standards and listings published prior to 1943 whereby a wood stud wall assembly with gypsum or lime plaster on hand split or sawn wooden lath obtains a one-half-hour fire-resistive rating. This rating may be increased for interior walls to as much as one hour by filling the wall with mineral fiber or glass fiber.

### SECTION 8-405 OCCUPANCY SEPARATION

See Chapter 8-3.

### SECTION 8-406 MAXIMUM FLOOR AREA

See Chapter 8-3.

### SECTION 8-407 VERTICAL SHAFTS

Vertical shafts need not be enclosed when such shafts are blocked at every floor level by the installation of not less than 2 full inches (51 mm) of solid wood or equivalent construction installed so as to prevent the initial passage of smoke and flame. Automatic sprinkler systems or other solutions may be considered on a case-by-case basis, in lieu of enclosure of vertical shafts and stairwells.

### SECTION 8-408 ROOF COVERING

Existing or original roofing materials may be repaired or reconstructed subject to the following requirements:

1. The original or historical roofing system shall be detailed or modified as necessary in order to be capable of providing shelter while preserving the historical materials and appearance of the roof.
2. Wooden roof materials may be utilized where fire resistance is required, provided they are treated with

fire-retardant treatments to achieve a Class “B” roof covering rating. Wood roofing in state designated Urban Wildland and High Fire Zones shall be permitted when installed in class “A” assemblies.

3. Jurisdictions that prohibit wood roofing materials for application as roof coverings and roof assemblies shall submit documentation for the adoption. Express Terms, statement of reasons and minutes of the action by the adopting authority Health and Safety Code, Section 18959(f).

#### **SECTION 8-409 FIRE ALARM SYSTEMS**

Every qualified historical building or property shall be provided with fire alarm systems as required for the use or occupancy by the regular code or other approved alternative.

#### **SECTION 8-410 AUTOMATIC SPRINKLER SYSTEMS**

**8-410.1** Every qualified historical building or property which cannot be made to conform to the construction requirements specified in the regular code for the occupancy or use, and which constitutes a distinct fire hazard (for definition of “distinct hazard,” see Chapter 8-2), shall be deemed to be in compliance if provided with an automatic sprinkler system or a life-safety system or other technologies as approved by the enforcing agency. (“Automatic” is defined in the regular code. Sprinkler System is defined in this section.)

**8-410.2** When required by the CHBC, an automatic sprinkler systems is defined by the following standards (for nonhazardous occupancies).

1. Buildings of four stories or less: NFPA 13R, 2002 edition.
2. For floors above the fourth, NFPA 13, 2002, SFM amended edition.
3. Buildings with floors above 75 feet, NFPA 13, 2002 edition.
4. When the building is free standing or with property line separation, two floors and 1500 sf per floor or less, NFPA 13D, 2002 Edition.
5. For exterior wall and opening protection. As required by this section.

**Exception:** When the automatic sprinkler systems are used to reach compliance using this code, in three or more occasions, the system shall be NFPA standard 13D shall be increased to NFPA 13R Standard, or NFPA 13R standard shall be increased to a NFPA 13 standard.

**8-410.3** Automatic sprinkler systems shall not be used to substitute for or act as an alternate to the required number of exits from any facility. (See Chapter 8-5 for exiting requirements.)

**8-410.4** An automatic sprinkler system shall be provided in all detention facilities.

#### **SECTION 8-411 OTHER TECHNOLOGIES**

Fire alarm systems, smoke and heat detection systems, occupant notification and annunciation systems, smoke control systems and fire modeling, times egress analysis and modeling, as well as other engineering methods and technologies may be accepted by the enforcing agency to address areas of non-conformance.

#### **SECTION 8-412 HIGH-RISE BUILDINGS**

Qualified historical buildings having floors for human occupancy located more than 75 feet above the lowest floor level having building access shall conform to the provisions of the regular code for existing high-rise buildings as amended by the CHBC.

## CHAPTER 8-5

# MEANS OF EGRESS

### SECTION 8-501 PURPOSE, INTENT AND SCOPE

**8-501.1 Purpose.** The purpose of this chapter is to establish minimum means of egress regulations for qualified historical buildings or properties. The CHBC requires enforcing agencies to accept reasonably equivalent alternatives to the means of egress requirements in the regular code.

**8-501.2 Intent.** The intent of these regulations is to provide an adequate means of egress.

**8-501.3 Scope.** Every qualified historical building or portion thereof shall be provided with exits as required by the CHBC when required by the provisions of Section 8-102.

### SECTION 8-502 GENERAL

**8-502.1 General.** The enforcing agency shall grant reasonable exceptions to the specific provisions of applicable egress regulations where such exceptions will not adversely affect life safety.

**8-502.2.** Existing door openings and corridor widths of less than dimensions required by regular code shall be permitted where there is sufficient width and height for the occupants to pass through the opening or traverse the exit.

**8-502.3 Stairs.** Existing stairs having risers and treads or width at variance with the regular code are allowed if determined by the enforcing agency to not constitute a distinct hazard. Handrails with nonconforming grip size or extensions are allowed if determined by the enforcing agency to not constitute a distinct hazard.

**8-502.4 Main entry doors.** The front or main entry doors need not be rehung to swing in the direction of exit travel, provided other means or conditions of exiting, as necessary to serve the total occupant load, are provided.

**8-502.5 Existing fire escapes.** Existing previously approved fire escapes and fire escape ladders shall be acceptable as one of the required means of egress, provided they extend to the ground and are easily negotiated, adequately signed and in good working order. Access shall be by an opening having a minimum width of 29 inches (737mm) when open with a sill no more than 30 inches (762mm) above the adjacent floor, landing or approved step.

**8-502.6 New fire escapes and fire escape ladders.** New fire escapes and fire escape ladders which comply with this section shall be acceptable as one of the required means of egress. New fire escapes and new fire escape ladders shall comply with the following:

1. Access from a corridor shall not be through an intervening room.
2. All openings within 10 feet (3048 mm) shall be protected by three-fourths-hour fire assemblies. When

located within a recess or vestibule, adjacent enclosure walls shall be of not less than one-hour fire-resistive construction.

3. Egress from the building shall be by a clear opening having a minimum dimension of not less than 29 inches (737 mm). Such openings shall be openable from the inside without the use of a key or special knowledge or effort. The sill of an opening giving access shall not be more than 30 inches (737 mm) above the floor, step or landing of the building or balcony.
4. Fire escape stairways and balconies shall support the dead load plus a live load of not less than 100 pounds per square foot (4.79 kN/m<sup>2</sup>) and shall be provided with a top and intermediate handrail on each side. The pitch of the stairway shall not exceed 72 degrees with a minimum width of 18 inches (457 mm). Treads shall not be less than 4 inches (102 mm) in width, and the rise between treads shall not exceed 10 inches (254 mm). All stair and balcony railings shall support a horizontal force of not less than 50 pounds per lineal foot (729.5 N/m<sup>2</sup>) of railing.
5. Balconies shall not be less than 44 inches (1118 mm) in width with no floor opening other than the stairway opening greater than  $\frac{5}{8}$  inch (15.9 mm) in width. Stairway openings in such balconies shall not be less than 22 inches by 44 inches (559 by 1118 mm). The balustrade of each balcony shall not be less than 36 inches (914 mm) high with not more than 9 inches (287 mm) between balusters.
6. Fire escapes shall extend to the roof or provide an approved gooseneck ladder between the top floor landing and the roof when serving buildings four or more stories in height having roofs with less than 4 units vertical in 12 units horizontal (33.3 percent slope). Fire escape ladders shall be designed and connected to the building to withstand a horizontal force of 100 pounds (445 N) placed anywhere on the rung. All ladders shall be at least 15 inches (381 mm) wide, located within 12 inches (305 mm) of the building. Ladder rungs shall be  $\frac{3}{4}$  inch (19.1 mm) in diameter and shall be located 12 inches (305 mm) on center. Openings for roof access ladders through cornices and similar projections shall have minimum dimensions of 30 inches by 33 inches (762 by 838 mm).

The length of fire escapes and exit ladder devices shall be limited to that approved by the building official based on products listed by a recognized testing laboratory.

7. The lowest balcony shall not be more than 18 feet (5486 mm) from the ground. Fire escapes shall extend to the ground or be provided with counterbalanced stairs reaching to the ground.



## **MEANS OF EGRESS**

8. Fire escapes shall not take the place of stairways required by the codes under which the building was constructed.
9. Fire escapes shall be kept clear and unobstructed at all times and maintained in good working order.

### **SECTION 8-503**

#### **ESCAPE OR RESCUE WINDOWS AND DOORS**

Basements in dwelling units and every sleeping room below the fourth floor shall have at least one openable window or door approved for emergency escape which shall open directly into a public street, public way, yard or exit court. Escape or rescue windows or doors shall have a minimum clear area of 3.3 square feet (0.31 m<sup>2</sup>) and a minimum width or height dimension of 18 inches (457 mm) and be operable from the inside to provide a full, clear opening without the use of special tools.

### **SECTION 8-504**

#### **RAILINGS AND GUARDRAILS**

The height of railings and guard railings and the spacing of balusters may continue in their historical height and spacing unless a distinct hazard has been identified or created by a change in use or occupancy.

## CHAPTER 8-6

# ACCESSIBILITY

### SECTION 8-601 PURPOSE, INTENT AND SCOPE

**8-601.1 Purpose.** The purpose of the CHBC is to provide alternative regulations to facilitate access and use by persons with disabilities to and throughout facilities designated as qualified historical buildings or properties. These regulations require enforcing agencies to accept alternatives to regular code when dealing with qualified historical buildings or properties.

**8-601.2 Intent.** The intent of this chapter is to preserve the integrity of qualified historical buildings and properties while providing access to and use by persons with disabilities.

**8-601.3 Scope.** The CHBC shall apply to every qualified historical building or property that is required to provide access to persons with disabilities.

1. Provisions of this chapter do not apply to new construction or reconstruction/replicas of historical buildings.
2. Where provisions of this chapter apply to alteration of qualified historical buildings or properties, alteration is defined in *California Building Code (CBC)*, Chapter 2, Definitions and Abbreviations. 202 – A. Alter or Alteration.

**8-601.4 General application.** The provisions in the CHBC apply to local, state and federal governments (Title II entities); alteration of commercial facilities and places of public accommodation (Title III entities); and barrier removal in commercial facilities and places of public accommodation (Title III entities). Except as noted in this chapter.

### SECTION 8-602 BASIC PROVISIONS

**8-602.1 Regular code.** The regular code for access for people with disabilities (Title 24, Part 2, Vol. 1, Chapter 11B) shall be applied to qualified historical buildings or properties unless strict compliance with the regular code will threaten or destroy the historical significance or character-defining features of the building or property.

**8-602.2 Alternative provisions.** If the historical significance or character-defining features are threatened, alternative provisions for access may be applied pursuant to this chapter, provided the following conditions are met:

1. These provisions shall be applied only on an item-by-item or a case-by-case basis.
2. Documentation is provided, including meeting minutes or letters, stating the reasons for the application of the alternative provisions. Such documentation shall be retained in the permanent file of the enforcing agency.

### SECTION 8-603 ALTERNATIVES

**8-603.1 Alternative minimum standards.** The alternative minimum standards for alterations of qualified historical buildings or facilities are contained in Section 4.1.7(3) of ADA Standards for Accessible Design, as incorporated and set forth in federal regulation 28 C.F.R. Pt. 36.

**8-603.2 Entry.** These alternatives do not allow exceptions for the requirement of level landings in front of doors, except as provided in Section 8-603.4.

1. Access to any entrance used by the general public and no further than 200 feet (60 960 mm) from the primary entrance.
2. Access at any entrance not used by the general public but open and unlocked with directional signs at the primary entrance and as close as possible to, but no further than 200 feet (60 960 mm) from, the primary entrance.
3. The accessible entrance shall have a notification system. Where security is a problem, remote monitoring may be used.

**8-603.3 Doors.** Alternatives listed in order of priority are:

1. Single-leaf door which provides a minimum 30 inches (762 mm) of clear opening.
2. Single-leaf door which provides a minimum 29½ inches (749 mm) clear opening
3. Double door, one leaf of which provides a minimum 29½ inches (749 mm) clear opening.
4. Double doors operable with a power-assist device to provide a minimum 29½ inches (749 mm) clear opening when both doors are in the open position.

**8-603.4 Power-assisted doors.** Power-assisted door or doors may be considered an equivalent alternative to level landings, strikeside clearance and door-opening forces required by the regular code.

**8-603.5 Toilet rooms.** In lieu of separate-gender toilet facilities as required in the regular code, an accessible unisex toilet facility may be designated.

**8-603.6 Exterior and interior ramps and lifts.** Alternatives listed in order of priority are:

1. A lift or a ramp of greater than standard slope but no greater than 1:10, for horizontal distances not to exceed 5 feet (1525 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope.
2. Access by ramps of 1:6 slope for horizontal distance not to exceed 13 inches (330 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope.

## SECTION 8-604 EQUIVALENT FACILITATION

Use of other designs and technologies, or deviation from particular technical and scoping requirements, are permitted if the application of the alternative provisions contained in Section 8-603 would threaten or destroy the historical significance or character-defining features of the historical building or property.

1. Such alternatives shall be applied only on an item-by-item or a case-by-case basis.
2. Access provided by experiences, services, functions, materials and resources through methods including, but not limited to, maps, plans, videos, virtual reality and related equipment, at accessible levels. The alternative design and/or technologies used will provide substantially equivalent or greater accessibility to, and usability of, the facility.
3. The official charged with the enforcement of the standards shall document the reasons for the application of the design and/or technologies and their effect on the historical significance or character-defining features. Such documentation shall be in accordance with Section 8-602.2, Item 2, and shall include the opinion and comments of state or local accessibility officials, and the opinion and comments of representative local groups of people with disabilities. Such documentation shall be retained in the permanent file of the enforcing agency. Copies of the required documentation should be available at the facility upon request.

**Note:** For commercial facilities and places of public accommodation (Title III entities).

Equivalent facilitation for an element of a building or property when applied as a waiver of an ADA accessibility requirement will not be entitled to the Federal Department of Justice certification of this code as rebuttable evidence of compliance for that element.

## CHAPTER 8-7

# STRUCTURAL REGULATIONS

### SECTION 8-701 PURPOSE, INTENT AND SCOPE

**8-701.1 Purpose.** The purpose of the CHBC is to provide alternative regulations to the regular code for the structural safety of buildings designated as qualified historical buildings or properties. The CHBC requires enforcing agencies to accept any reasonably equivalent alternatives to the regular code when dealing with qualified historical buildings or properties.

**8-701.2 Intent.** The intent of this chapter is to encourage the preservation of qualified historical buildings or structures while providing standards for a minimum level of building performance with the objective of preventing partial or total structural collapse such that the overall risk of life-threatening injury as a result of structural collapse is low.

**8-701.3 Application.** The alternative structural regulations provided by Section 8-705 are to be applied in conjunction with the regular code whenever a structural upgrade or reconstruction is undertaken for qualified historical buildings or properties.

### SECTION 8-702 GENERAL

**8-702.1** The CHBC shall not be construed to allow the enforcing agency to approve or permit a lower level of safety of structural design and construction than that which is reasonably equivalent to the regular code provisions in occupancies which are critical to the safety and welfare of the public at large, including, but not limited to, public and private schools, hospitals, municipal police and fire stations and essential services facilities.

**8-702.2** Nothing in these regulations shall prevent voluntary and partial seismic upgrades when it is demonstrated that such upgrades will improve life safety and when a full upgrade would not otherwise be required.

### SECTION 8-703 STRUCTURAL SURVEY

**8-703.1 Scope.** When a structure or portion of a structure is to be evaluated for structural capacity under the CHBC, it shall be surveyed for structural conditions by an architect or engineer knowledgeable in historical structures. The survey shall evaluate deterioration or signs of distress. The survey shall determine the details of the structural framing and the system for resistance of gravity and lateral loads. Details, reinforcement and anchorage of structural systems and veneers shall be determined and documented where these members are relied on for seismic lateral resistance.

**8-703.2** The results of the survey shall be utilized for evaluating the structural capacity and for designing modifications to the structural system to reach compliance with this code.

**8-703.3 Historical records.** Past historical records of the structure or similar structures may be used in the evaluation, including the effects of subsequent alterations.

### SECTION 8-704 NONHISTORICAL ADDITIONS AND NONHISTORICAL ALTERATIONS

**8-704.1** New nonhistorical additions and nonhistorical alterations which are structurally separated from an existing historical building or structure shall comply with regular code requirements.

**8-704.2** New nonhistorical additions which impose vertical or lateral loads on an existing structure shall not be permitted unless the affected part of the supporting structure is evaluated and strengthened, if necessary, to meet regular code requirements.

**Note:** For use of archaic materials, see Chapter 8-8.

### SECTION 8-705 STRUCTURAL REGULATIONS

**8-705.1 Gravity loads.** The capacity of the structure to resist gravity loads shall be evaluated and the structure strengthened as necessary. The evaluation shall include all parts of the load path. Where no distress is evident, and a complete load path is present, the structure may be assumed adequate by having withstood the test of time if anticipated dead and live loads will not exceed those historically present.

**8-705.2 Wind and seismic loads.** The ability of the structure to resist wind and seismic loads shall be evaluated. Wind loads shall be considered when appropriate, but need not exceed 75% of the wind loads prescribed by the regular code. The evaluation shall be based on the requirements of Section 8-706.

**8-705.2.1** Any unsafe conditions in the lateral-load-resisting system shall be corrected, or alternative resistance shall be provided. When strengthening is required, additional resistance shall be provided to meet the minimum requirements of the CHBC. The strengthening measures shall be selected with the intent of meeting the performance objectives set forth in Section 8-701.2. The evaluation of structural members and structural systems for seismic loads shall consider the inelastic performance of structural members and their ability to maintain load-carrying capacity during the seismic loadings prescribed by the regular code.

**8-705.2.2** The architect or engineer shall consider additional measures with minimal loss of, and impact to, historical materials which will reduce damage and needed repairs in future earthquakes to better preserve the historical structure in perpetuity. These additional measures shall be presented to the owner for consideration as part of the rehabilitation or restoration.

## SECTION 8-706 LATERAL LOAD REGULATIONS

**8-706.1 Seismic forces.** Strength-level seismic forces used to evaluate the structure for resistance to seismic loads shall be based on the *R*-values tabulated in the regular code for similar lateral-force-resisting systems including consideration of the structural detailing of the members where such *R*-values exist. Where such *R*-values do not exist, an appropriate *R*-value shall be rationally assigned considering the structural detailing of the members.

### Exceptions:

1. The forces need not exceed 0.75 times the seismic forces prescribed by the regular code requirements.
2. For Occupancy Category I, II or III structures, near-fault increases in ground motion (maximum considered earthquake ground motion of 0.2 second spectral response greater than 150 percent at 5 percent damping) need not be considered when the fundamental period of the building is 0.5 seconds in the direction under consideration.
3. For Occupancy Category I or II structures, the seismic base shear need not exceed 0.30W.
4. For Occupancy Category III or IV structures, the seismic base shear need not exceed 0.40W.

**8-706.1.1** When a building is to be strengthened with the addition of a new lateral force resisting system, the *R* value of the new system can be used when the new lateral force resisting system resists at least 75 percent of the building's base shear regardless of its relative rigidity.

**8-706.1.2** Unreinforced masonry bearing wall buildings shall comply with the *California Existing Building Code* (CEBC), Appendix Chapter A1, 2010 Edition, and as modified by the CHBC. Alternative standards may be used on a case-by-case basis when approved by the authority having jurisdiction. It shall be permitted to exceed the strength limitation of 100 psi in Section A108.2 of the CEBC when test data and building configuration supports higher values subject to the approval of the authority having jurisdiction.

**8-706.1.3** All deviations from the detailing provisions of the lateral-force-resisting systems shall be evaluated for stability and the ability to maintain load-carrying capacity at the expected inelastic deformations.

**8-706.2 Existing building performance.** The seismic resistance may be based upon the ultimate capacity of the structure to perform, giving due consideration to ductility and reserve strength of the lateral-force-resisting system and materials while maintaining a reasonable factor of safety. Broad judgment may be exercised regarding the strength and performance of materials not recognized by regular code requirements. (See Chapter 8-8, Archaic Materials and Methods of Construction.)

**8-706.2.1** All structural materials or members that do not comply with detailing and proportioning requirements of the regular code shall be evaluated for potential seismic performance and the consequence of non-compliance. All members that would be reasonably expected to fail and lead to collapse or life threatening injury when subjected to seismic demands shall be judged unacceptable, and appropriate structural strengthening shall be developed.

**8-706.3 Load path.** A complete and continuous load path, including connections, from every part or portion of the structure to the ground shall be provided for the required forces. It shall be verified that the structure is adequately tied together to perform as a unit when subjected to earthquake forces.

**8-706.4 Parapets.** Parapets and exterior decoration shall be investigated for conformance with regular code requirements for anchorage and ability to resist prescribed seismic forces.

An exception to regular code requirements shall be permitted for those parapets and decorations which are judged not to be a hazard to life safety.

**8-706.5 Nonstructural features.** Nonstructural features of historical structure, such as exterior veneer, cornices and decorations, which might fall and create a life-safety hazard in an earthquake, shall be evaluated. Their ability to resist seismic forces shall be verified, or the feature shall be strengthened with improved anchorage when appropriate.

**8-706.5.1** Partitions and ceilings of corridors and stairways serving an occupant load of 30 or more shall be investigated to determine their ability to remain in place when the building is subjected to earthquake forces.



## CHAPTER 8-8

# ARCHAIC MATERIALS AND METHODS OF CONSTRUCTION

### SECTION 8-801 PURPOSE, INTENT AND SCOPE

**8-801.1 Purpose.** The purpose of the CHBC is to provide regulations for the use of historical methods and materials of construction that are at variance with regular code requirements or are not otherwise codified, in buildings or structures designated as qualified historical buildings or properties. The CHBC require enforcing agencies to accept any reasonably equivalent alternatives to the regular code when dealing with qualified historical buildings or properties.

**8-801.2 Intent.** It is the intent of the CHBC to provide for the use of historical methods and materials of construction that are at variance with specific code requirements or are not otherwise codified.

**8-801.3 Scope.** Any construction type or material that is, or was, part of the historical fabric of a structure is covered by this chapter. Archaic materials and methods of construction present in a historical structure may remain or be reinstalled or be installed with new materials of the same class to match existing conditions.

### SECTION 8-802 GENERAL ENGINEERING APPROACHES

Strength values for archaic materials shall be assigned based upon similar conventional codified materials, or on tests as hereinafter indicated. The archaic materials and methods of construction shall be thoroughly investigated for their details of construction in accordance with Section 8-703. Testing shall be performed when applicable to evaluate existing conditions. The architect or structural engineer in responsible charge of the project shall assign allowable stresses or strength levels to archaic materials. Such assigned strength values shall not be greater than those provided for in the following sections without adequate testing, and shall be subject to the concurrence of the enforcing agency.

### SECTION 8-803 NONSTRUCTURAL ARCHAIC MATERIALS

Where nonstructural historical materials exist in uses which do not meet the requirements of the regular code, their continued use is allowed by this code, provided that any public health and life-safety hazards are mitigated subject to the concurrence of the enforcing agency.

### SECTION 8-804 ALLOWABLE CONDITIONS FOR SPECIFIC MATERIALS

Archaic materials which exist and are to remain in qualified historical buildings or structures shall be evaluated for their condition and for loads required by this code. The structural

survey required in Section 8-703 of the CHBC shall document existing conditions, reinforcement, anchorage, deterioration and other factors pertinent to establishing allowable stresses, strength levels and adequacy of the archaic materials. The remaining portion of this chapter provides additional specific requirements for commonly encountered archaic materials.

### SECTION 8-805 MASONRY

For adobe, see Section 8-806.

**8-805.1 Existing solid masonry.** Existing solid masonry walls of any type, except adobe, may be allowed, without testing, a maximum ultimate strength of nine pounds per square inch (62.1 kPa) in shear where there is a qualifying statement by the architect or engineer that an inspection has been made, that mortar joints are filled and that both brick and mortar are reasonably good. The shear stress above applies to unreinforced masonry, except adobe, where the maximum ratio of unsupported height or length to thickness does not exceed 13, and where minimum quality mortar is used or exists. Wall height or length is measured to supporting or resisting elements that are at least twice as stiff as the tributary wall. Stiffness is based on the gross section. Shear stress may be increased by the addition of 10 percent of the axial direct stress due to the weight of the wall directly above. Higher-quality mortar may provide a greater shear value and shall be tested in accordance with Appendix A, Chapter A1 of the *California Existing Building Code* (CEBC) 2010 edition, and as modified by the CHBC.

#### 8-805.2 Stone masonry.

**8-805.2.1 Solid-backed stone masonry.** Stone masonry solidly backed with brick masonry shall be treated as solid brick masonry as described in Section 8-805.1 and in the 2009 IEBC, provided representative testing and inspection verifies solid collar joints between stone and brick and that a reasonable number of stones lap with the brick wythes as headers or that steel anchors are present. Solid stone masonry where the wythes of stone effectively overlap to provide the equivalent header courses may also be treated as solid brick masonry.

**8-805.2.2 Independent wythe stone masonry.** Stone masonry with independent face wythes may be treated as solid brick masonry as described in Section 8-805.1 and the CEBC, provided representative testing and inspection verify that the core is essentially solid in the masonry wall and that steel ties are epoxied in drilled holes between outer stone wythes at floors, roof and not to exceed 4 feet (1219 mm) on center in each direction, between floors and roof. A reinforcing element shall exist or be provided at or near the top of all stone masonry walls.

**8-805.2.3 Testing of stone masonry.** Testing of stone masonry shall be similar to the 2010 CEBC requirements

for brick masonry, except that representative stones which are not interlocked shall be pulled outward from the wall and shear area appropriately calculated after the test.

**8-805.3 Reconstructed walls.** Totally reconstructed walls utilizing original brick or masonry, constructed similar to original, shall be constructed in accordance with the regular code. Repairs or infills may be constructed in a similar manner to the original walls without conforming to the regular code.

## SECTION 8-806 ADOBE

**8-806.1 General.** Unburned clay masonry may be constructed, reconstructed, stabilized or rehabilitated subject to this chapter. Alternative approaches which provide an equivalent or greater level of safety may be used, subject to the concurrence of the enforcing agency.

**8-806.2 Moisture protection.** Provisions shall be in-place to protect adobe structures from deterioration due to moisture penetration. Adobe shall be maintained in reasonably good condition. Particular attention shall be given to moisture content of adobe walls. Unmaintained walls or ruins shall be evaluated for safety based on their condition and stability. Additional protection measures may be appropriate subject to the concurrence of the enforcing agency.

**8-806.3 Height to thickness ratio.** Unreinforced new or existing adobe walls shall meet these criteria need not be evaluated for out of plane failure. Where existing dimensions do not meet these conditions, additional strengthening measures, such as a bond beam, may be appropriate. Existing sod or rammed earth walls shall be considered similar to the extent these provisions apply.

1. One-story adobe load-bearing walls shall not exceed a height-to-thickness ratio of 6.
2. Two-story adobe buildings or structures' height-to-thickness wall ratio shall not exceed 6 at the ground floor and 5 at the second floor, and shall be measured at floor-to-floor height when the second floor and attic ceiling/roof are connected to the wall as described below.

**8-806.4 Nonload-bearing adobe.** Nonload-bearing adobe partitions and gable end walls shall be evaluated for stability and anchored against out-of-plane failure if necessary.

**8-806.5 Bond beam.** Where provided, a bond beam or equivalent structural element shall be located at the top of all adobe walls, and at the second floor for two-story buildings or structures. The size and configuration of the structural element shall be sufficient to provide an effective brace for the wall, to tie the building together and to connect the wall to the floor or roof.

**8-806.6 Repair or reconstruction.** Repair or reconstruction of wall area may utilize unstabilized brick or adobe masonry designed to be compatible with the constituents of the existing adobe materials.

**8-806.7 Shear values.** Existing adobe may be allowed a maximum strength level of twelve pounds per square inch (82.7 kPa) for shear.

**8-806.8 Mortar.** Mortar may be of the same soil composition as that used in the existing wall, or in new walls as necessary to be compatible with the adobe brick.

## SECTION 8-807 WOOD

**8-807.1 Existing wood diaphragms or walls.** Existing wood diaphragms or walls of straight or diagonal sheathing shall be assigned shear resistance values appropriate with the fasteners and materials functioning in conjunction with the sheathing. The structural survey shall determine fastener details and spacings and verify a load path through floor construction. Shear values of Tables 8-8-A and 8-8-B.

**8-807.2 Wood lath and plaster.** Wood lath and plaster walls and ceilings may be utilized using the shear values referenced in Section 8-807.1.

**8-807.3 Existing wood framing.** Existing wood framing members may be assigned allowable stresses consistent with codes in effect at the time of construction. Existing or new replacement wood framing may be of archaic types originally used if properly researched, such as balloon and single wall. Wood joints such as dovetail and mortise and tenon types may be used structurally, provided they are well made. Lumber selected for use and type need not bear grade marks, and greater or lesser species such as low-level pine and fir, box-wood and indigenous hardwoods and other variations may be used for specific conditions where they were or would have been used.

Wood fasteners such as square or cut nails may be used with a maximum increase of 50 percent over wire nails for shear.

## SECTION 8-808 CONCRETE

**8-808.1 Materials.** Natural cement concrete, unreinforced rubble concrete and similar materials may be utilized wherever that material is used historically. Concrete of low strength and with less reinforcement than required by the regular code may remain in place. The architect or engineer shall assign appropriate values of strength based on testing of samples of the materials. Bond and development lengths shall be determined based on historical information or tests.

**8-808.2 Detailing.** The architect or engineer shall carefully evaluate all detailing provisions of the regular code which are not met and shall consider the implications of these variations on the ultimate performance of the structure, giving due consideration to ductility and reserve strength.

## SECTION 8-809 STEEL AND IRON

The hand-built, untested use of wrought or black iron, the use of cast iron or grey iron, and the myriad of joining methods that are not specifically allowed by code may be used wherever applicable and wherever they have proven their worth under the considerable span of years involved with most qualified historical buildings or structures. Uplift capacity should be evaluated

and strengthened where necessary. Fixed conditions or midheight lateral loads on cast iron columns that could cause failure should be taken into account. Existing structural wrought, forged steel or grey iron may be assigned the maximum working stress prevalent at the time of original construction.

## SECTION 8-810 HOLLOW CLAY TILE

The historical performance of hollow clay tile in past earthquakes shall be carefully considered in evaluating walls of hollow clay tile construction. Hollow clay tile bearing walls shall be evaluated and strengthened as appropriate for lateral loads and their ability to maintain support of gravity loads. Suitable protective measures shall be provided to prevent blockage of exit stairways, stairway enclosures, exit ways and public ways as a result of an earthquake.

## SECTION 8-811 VENEERS

**8-811.1 Terra cotta and stone.** Terra cotta, cast stone and natural stone veneers shall be investigated for the presence of suit-

able anchorage. Steel anchors shall be investigated for deterioration or corrosion. New or supplemental anchorage shall be provided as appropriate.

**8-811.2 Anchorage.** Brick veneer with mechanical anchorage at spacings greater than required by the regular code may remain, provided the anchorages have not corroded. Nail strength in withdrawal in wood sheathing may be utilized to its capacity in accordance with code values.

## SECTION 8-812 GLASS AND GLAZING

**8-812.1 Glazing subject to human impact.** Historical glazing material located in areas subject to human impact may be approved subject to the concurrence of the enforcing agency when alternative protective measures are provided. These measures may include, but not be limited to, additional glazing panels, protective film, protective guards or systems, and devices or signs which would provide adequate public safety.

**8-812.2 Glazing in fire-rated systems.** See Section 8-402.3.

TABLE 8-8A  
STRENGTH VALUES FOR EXISTING MATERIALS

EXISTING MATERIALS OR CONFIGURATIONS OF MATERIALS <sup>1</sup>	STRENGTH LEVEL CAPACITY x14.594 for N/m
1. Horizontal diaphragms <sup>2</sup>	
1.1 Roofs with straight sheathing and roofing applied directly to the sheathing	300 lbs per foot for seismic shear
1.2 Roofs with diagonal sheathing and roofing applied directly to the sheathing	750 lbs per foot for seismic shear
1.3 Floors with straight tongue-and-groove sheathing	300 lbs per foot for seismic shear
1.4 Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular	1,500 lbs per foot for seismic shear
1.5 Floors with diagonal sheathing and finished	1,800 lbs per foot for seismic shear
2. Crosswalls <sup>2,3</sup>	
2.1 Plaster on wood or metal lath	Per side: 600 lbs per foot for seismic shear
2.2 Plaster on gypsum lath	550 lbs per foot for seismic shear
2.3 Gypsum wallboard, unblocked edges	200 lbs per foot for seismic shear
2.4 Gypsum wallboard, blocked edges	400 lbs per foot for seismic shear
3. Existing footings, wood framing, structural steel and reinforcing steel	
3.1 Plain concrete footings	$f'_c = 1,500$ psi (10.34 MPa) unless otherwise shown by tests <sup>3</sup>
3.2 Douglas fir wood	Allowable stress same as D.F. No. 1 <sup>3</sup>
3.3 Reinforcing steel	$f_t = 40,000$ lbs per square inch (124.1 N/mm <sup>2</sup> ) maximum
3.4 Structural steel	$f_t = 33,000$ lbs per square inch (137.9 N/mm <sup>2</sup> ) maximum

<sup>1</sup>Material must be sound and in good condition.

<sup>2</sup>Shear values of these materials may be combined, except the total combined value shall not exceed 900 pounds per foot (13,140 N/m).

<sup>3</sup>Stresses given may be increased for combinations of loads as specified in the regular code.



**TABLE 8-8B**  
**STRENGTH VALUES OF NEW MATERIALS USED IN CONNECTION WITH EXISTING CONSTRUCTION**

NEW MATERIALS OR CONFIGURATIONS OF MATERIALS	STRENGTH LEVEL CAPACITY <sup>1</sup>
<p>1. Horizontal diaphragms<sup>2</sup></p> <p>1.1 <math>\frac{15}{32}</math> inch minimum plywood sheathing fastened directly over existing straight sheathing with edges of plywood located on center of individual sheathing boards and fastened with minimum #8x <math>1\frac{1}{4}</math> inch wood screws or nails with helical threads 0.13 inch min. diameter and <math>1\frac{1}{4}</math> inch min. length at 4 inch centers all panel edges and 12 inch centers each way in field.</p> <p>1.2 Same plywood and attachments as 1.1 fastened directly over existing diagonal sheathing.</p> <p>1.3 <math>\frac{3}{8}</math> inch plywood sheathing fastened directly over existing straight or diagonal sheathing with ends and edges on centers of individual sheathing boards and fastened with #6 wood screws or nails with helical threads 0.13 inch minimum diameter and <math>1\frac{1}{4}</math> inch min. length at 6 inch centers all panel edges and 12 inch centers each way in field.</p>	<p>1,500 lbs per foot</p> <p>1,800 lbs per foot</p> <p>900 lbs per foot</p>
<p>2. Shear walls:</p> <p>Plywood sheathing applied directly over wood studs. No value shall be given to plywood applied over existing plaster or wood sheathing</p>	<p>100 percent of the value specified in the regular code for shear walls</p>
<p>3. Crosswalls: (special procedure only)</p> <p>3.1 Plywood sheathing applied directly over wood studs. No value shall be given to plywood applied over existing plaster or wood sheathing</p> <p>3.2 Drywall or plaster applied directly over wood studs</p> <p>3.3 Drywall or plaster applied to sheathing over existing wood studs</p>	<p>133 percent of the value specified in the regular code for shear walls</p> <p>100 percent of the values in the regular code</p> <p>50 percent of the values specified in the regular code</p>
<p>4. Tension bolts</p> <p>a. Bolts extending entirely through unreinforced masonry walls secured with bearing plates on far side of a three-wythe-minimum wall with at least 30 square inches (19 350 mm<sup>2</sup>) of area<sup>4,5</sup></p> <p>b. All thread rod extending to the exterior face of the wall installed in adhesive<sup>9</sup></p>	<p>5,400 lbs (24,010 N) per bolt<sup>6</sup> 2,700 lbs (12,009 N) per bolt for two-wythe walls<sup>6</sup></p> <p>3,600 lbs (16,014 N) per bolt</p>
<p>5. Shear bolts</p> <p>Bolts embedded a minimum of 8 inches (203 mm) into unreinforced masonry walls and centered in a <math>2\frac{1}{2}</math>-inch-diameter (63.5 mm) hole filled with dry-pack or nonshrink grout. Through bolts with first 8 inches (203 mm) as noted above and embedded all thread rod as noted in Item 4.b<sup>5,7,9</sup></p>	<p><math>\frac{1}{2}</math> inch (12.7 mm) diameter = 1050 lbs (4671 N)<sup>6</sup> <math>\frac{5}{8}</math> inch (15.9 mm) diameter = 1500 lbs (6672 N)<sup>6</sup> <math>\frac{3}{4}</math> inch (19 mm) diameter = 2250 lbs (10,008 N)<sup>6</sup></p>
<p>6. Infilled walls</p> <p>Reinforced masonry infilled openings in existing unreinforced masonry walls. Provide keys or dowels to match reinforcing.</p>	<p>Same as values specified for unreinforced masonry walls</p>
<p>7. Reinforced masonry</p> <p>Masonry piers and walls reinforced per the regular code</p>	<p>Same as values specified in the regular code<sup>8</sup></p>
<p>8. Reinforced concrete</p> <p>Concrete footings, walls and piers reinforced as specified in the regular code and designed for tributary loads</p>	<p>Same values as specified in the regular code<sup>8</sup></p>

<sup>1</sup>Values are for strength level loads as defined in regular code standards.

<sup>2</sup>Values may be adjusted for other fasteners when approved by the enforcing authority.

<sup>3</sup>In addition to existing sheathing value.

<sup>4</sup>Bolts to be  $\frac{1}{2}$ -inch (12.7 mm) minimum diameter.

<sup>5</sup>Other bolt sizes, values and installation methods may be used provided a testing program is conducted in accordance with regular code standards. Bolt spacing shall not exceed 6 feet. (1830 mm) on center and shall not be less than 12 inches (305 mm) on center

<sup>6</sup>Other masonry based on tests or other substantiated data.

<sup>7</sup>Embedded bolts to be tested as specified in regular code standards.

<sup>8</sup>Stresses given may be increased for combinations of loads as specified in the regular code.

<sup>9</sup>Adhesives shall be approved by the enforcing agency and installed in accordance with the manufacturer's recommendations. All drilling dust shall be removed from drilled holes prior to installation.

## CHAPTER 8-9

# MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS

### SECTION 8-901 PURPOSE, INTENT AND SCOPE

**8-901.1 Purpose.** The purpose of the CHBC is to provide regulations for the mechanical, plumbing and electrical systems of buildings designated as qualified historical buildings or properties. The CHBC requires enforcing agencies to accept any reasonable equivalent solutions to the regular code when dealing with qualified historical buildings or properties.

**8-901.2 Intent.** The intent of the CHBC is to preserve the integrity of qualified historical buildings or properties while providing a reasonable level of protection from fire, health and life-safety hazards (hereinafter referred to as safety hazards) for the building occupants.

**8-901.3 Scope.** The CHBC shall be applied in conjunction with the regular code whenever compliance with the regular code is required for qualified historical buildings or properties.

**8-901.4 Safety hazard.** No person shall permit any safety hazard to exist on premises under their control, or fail to take immediate action to abate such hazard. Existing systems which constitute a safety hazard when operational may remain in place, provided they are completely and permanently rendered inoperative. Safety hazards created by inoperative systems shall not be permitted to exist. Requirements of the regular code concerning general regulations shall be complied with, except that the enforcing agency shall accept solutions which do not cause a safety hazard.

**8-901.5 Energy conservation.** Qualified historical buildings or properties covered by this part are exempted from compliance with energy conservation standards. When new nonhistorical lighting and space conditioning system components, devices, appliances and equipment are installed, they shall comply with the requirements of Title 24, Part 6, *The California Energy Code*, except where the historical significance or character-defining features are threatened.

### SECTION 8-902 MECHANICAL

**8-902.1 General.** Mechanical systems shall comply with the regular code unless otherwise modified by this chapter.

**8-902.1.1** The provisions of the CHBC shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any heating, ventilating, air conditioning, domestic incinerators, kilns or miscellaneous heat-producing appliances or equipment within or attached to a historical building.

**8-902.1.2** Existing systems which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain in use.

**8-902.1.3** The enforcing agency may approve any alternative to the CHBC which would achieve equivalent life safety.

**8-902.2 Heating facilities.** All dwelling-type occupancies covered under this chapter shall be provided with heating facilities. Wood-burning or pellet stoves or fireplaces may be acceptable as heating facilities.

**8-902.3 Fuel oil piping and tanks.** Fuel oil piping and tanks shall comply with regular code requirements except that the enforcing agency may waive such requirements where the lack of compliance does not create a safety or environmental hazard.

**8-902.4 Heat-producing and cooling equipment.** Heat-producing and cooling equipment shall comply with the regular code requirements governing equipment safety, except that the enforcing agency may accept alternatives which do not create a safety hazard.

#### 8-902.5 Combustion air.

**8-902.5.1** All fuel-burning appliances and equipment shall be provided a sufficient supply of air for proper fuel combustion, ventilation and draft hood dilution.

**8-902.5.2** The enforcing agency may require operational tests for combustion air systems which do not comply with applicable requirements of the regular code.

#### 8-902.6 Venting of appliances.

**8-902.6.1** Every appliance required to be vented shall be connected to an approved venting system. Venting systems shall develop a positive flow adequate to convey all combustion products to the outside atmosphere.

**8-902.6.2** Masonry chimneys in structurally sound condition may remain in use for all fuel-burning appliances, provided the flue is evaluated and documentation provided that the masonry and grout are in good condition. Terra cotta chimneys and Type C metallic vents installed in concealed spaces shall not remain in use unless otherwise mitigated and approved on a case-by-case basis.

**8-902.6.3** The enforcing agency may require operational tests for venting systems which do not comply with applicable requirements of the regular code.

#### 8-902.7 Ducts.

**8-902.7.1** New ducts shall be constructed and installed in accordance with applicable requirements of the regular code.

**8-902.7.2** Existing duct systems which do not comply with applicable requirements of the regular code and do not, in the opinion of the enforcing agency, constitute a safety or health hazard may remain in use.

#### 8-902.8 Ventilating systems.

**8-902.8.1** Ventilating systems shall be installed so that no safety hazard is created.

**8-902.8.2** Grease hoods and grease hood exhaust systems shall be furnished and installed in accordance with applicable requirements of the regular code. Existing systems which are altered shall comply with the regular code.

#### **8-902.9 Miscellaneous equipment requirements.**

**8-902.9.1** The following appliances and equipment shall be installed so that no safety hazard is created: warm air furnaces, space heating equipment, vented decorative appliances, floor furnaces, vented wall furnaces, unit heaters, room heaters, absorption units, refrigeration equipment, duct furnaces, infrared radiant heaters, domestic incinerators, miscellaneous heat-producing appliances and water heaters.

**8-902.9.2** Storage-type water heaters shall be equipped with a temperature- and pressure-relief valve in accordance with applicable requirements of the regular code.

### **SECTION 8-903 PLUMBING**

**8-903.1 General.** Plumbing systems shall comply with the regular code unless otherwise noted.

**8-903.1.1** The provisions of the CHBC shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any plumbing system or equipment within or attached to a historical building.

**8-903.1.2** Existing systems which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain in use.

**8-903.1.3** The enforcing agency may approve any alternative to these regulations which achieves reasonably equivalent life safety.

#### **8-903.2 Residential occupancies.**

**8-903.2.1** Where toilet facilities are provided, alternative sewage disposal methods may be acceptable if approved by the local health department. In hotels, where private facilities are not provided, water closets at the ratio of one for each 15 rooms may be acceptable.

**8-903.2.2** Toilet facilities are not required to be on the same floor or in the same building as sleeping rooms. Water-flush toilets may be located in a building immediately adjacent to the sleeping rooms. When alternative sewage disposal methods are utilized, they shall be located a minimum distance from the sleeping rooms or other locations as approved by the local health department.

**8-903.2.3** Kitchen sinks shall be provided in all kitchens. The sink and countertop may be of any smooth nonabsorbent finish which can be maintained in a sanitary condition.

**8-903.2.4** Hand washing facilities shall be provided for each dwelling unit and each hotel guest room. A basin and pitcher may be acceptable as adequate hand washing facilities.

**8-903.2.5** Hot or cold running water is not required for each plumbing fixture, provided a sufficient amount of water is supplied to permit the fixture's normal operation.

**8-903.2.6** Bathtubs and lavatories with filler spouts less than 1 inch (25.4 mm) above the fixture rim may remain in use, provided there is an acceptable overflow below the rim.

**8-903.2.7** Original or salvage water closets, urinals and flushometer valves shall be permitted in qualified historical buildings or properties. Historically accurate reproduction, nonlow-consumption water closets, urinals and flushometer valves shall be permitted except where historically accurate fixtures that comply with the regular code are available.

**8-903.3 Materials.** New nonhistorical materials shall comply with the regular code requirements. The enforcing agency shall accept alternative materials which do not create a safety hazard where their use is necessary to maintain the historical integrity of the building.

**8-903.4 Drainage and vent systems.** Plumbing fixtures shall be connected to an adequate drainage and vent system. The enforcing agency may require operational tests for drainage and vent systems which do not comply with applicable requirements of the regular code. Vent terminations may be installed in any location which, in the opinion of the enforcing agency, does not create a safety hazard.

**8-903.5 Indirect and special wastes.** Indirect and special waste systems shall be installed so that no safety hazard is created. Chemical or industrial liquid wastes which may detrimentally affect the sanitary sewer system shall be pretreated to render them safe prior to discharge.

**8-903.6 Traps and interceptors.** Traps and interceptors shall comply with the regular code requirements except that the enforcing agency shall accept solutions which do not increase the safety hazard. Properly maintained "S" and drum traps may remain in use.

#### **8-903.7 Joints and connections.**

**8-903.7.1** Joints and connections in new plumbing systems shall comply with applicable requirements of the regular code.

**8-903.7.2** Joints and connections in existing or restored systems may be of any type that does not create a safety hazard.

**8-903.8 Water distribution.** Plumbing fixtures shall be connected to an adequate water distribution system. The enforcing agency may require operational tests for water distribution systems which do not comply with applicable requirements of regular code. Prohibited (unlawful) connections and cross connections shall not be permitted.

**8-903.9 Building sewers and private sewage disposal systems.** New building sewers and new private sewage disposal systems shall comply with applicable requirements of the regular code.

**8-903.10 Fuel-gas piping.** Fuel-gas piping shall comply with the regular code requirements except that the enforcing agency shall accept solutions which do not increase the safety hazard.

## SECTION 8-904 ELECTRICAL

**8-904.1 General.** Electrical systems shall comply with the regular code unless otherwise permitted by this code, or approved by the authority having jurisdiction.

**8-904.1.1** The provisions of the CHBC shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any electrical system or portion thereof, the premise wiring, or equipment fixed in place as related to restoration within or attached to a qualified historical building or property.

**8-904.1.2** Existing systems, wiring methods and electrical equipment which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain in use.

**8-904.1.3** The enforcing agency may approve any alternative to the CHBC which achieves equivalent safety.

**8-904.1.4** Archaic methods that do not appear in present codes may remain and may be extended if, in the opinion of the enforcing agency, they constitute a safe installation.

### 8-904.2 Wiring methods.

**8-904.2.1** Where existing branch circuits do not include an equipment grounding conductor and, in the opinion of the enforcing agency, it is impracticable to connect an equipment grounding conductor to the grounding electrode system, receptacle convenience outlets may remain the nongrounding type.

**8-904.2.2** Ground fault circuit interrupter (GFCI) protected receptacles shall be installed where replacements are made at receptacle outlets that are required to be so protected by the regular code in effect at the time of replacement. Metallic face plates shall either be grounded to the grounded metal outlet box or be grounded to the grounding-type device when used with devices supplied by branch circuits without equipment grounding conductors.

**8-904.2.3** Grounding-type receptacles shall not be used without a grounding means in an existing receptacle outlet unless GFCI protected. Existing nongrounding receptacles shall be permitted to be replaced with nongrounding or grounding-type receptacles where supplied through a ground fault circuit interrupter.

**8-904.2.4** Extensions of existing branch circuits without equipment-grounding conductors shall be permitted to supply grounding-type devices only when the equipment grounding conductor of the new extension is grounded to any accessible point on the grounding electrode system.

**8-904.2.5** Receptacle outlet spacing and other related distance requirements shall be waived or modified if determined to be impracticable by the enforcing agency.

**8-904.2.6** For the replacement of lighting fixtures on an existing nongrounded lighting outlet, or when extending an existing nongrounding lighting outlet, the following shall apply:

1. The exposed conductive parts of lighting fixtures shall be connected to any acceptable point on the grounding electrode system, or

2. The lighting fixtures shall be made of insulating material and shall have no exposed conductive parts.

**Exception:** Lighting fixtures mounted on electrically nonconductive ceilings or walls where located not less than either 8 feet (2438 mm) vertically or 5 feet (1524 mm) horizontally from grounded surfaces.

**8-904.2.7** Lighting load calculations for services and feeders may be based on actual loads as installed in lieu of the "watts per square foot" method.

**8-904.2.8** Determination of existing loads may be based on maximum demand recordings in lieu of calculations, provided all of the following are met:

1. Recordings are provided by the serving agency.
2. The maximum demand data is available for a one-year period.

**Exception:** If maximum demand data for a one-year period is not available, the maximum demand data shall be permitted to be based on the actual amperes continuously recorded over a minimum 30-day period by a recording ammeter connected to the highest loaded phase of the feeder or service. The recording should reflect the maximum demand when the building or space is occupied and include the measured or calculated load at the peak time of the year, including the larger of the heating or cooling equipment load.

3. There has been no change in occupancy or character of load during the previous 12 months.
4. The anticipated load will not change, or the existing demand load at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.





## CHAPTER 8-10

# QUALIFIED HISTORICAL DISTRICTS, SITES AND OPEN SPACES

### SECTION 8-1001 PURPOSE AND SCOPE

**8-1001.1 Purpose.** The purpose of this chapter is to provide regulations for the preservation, rehabilitation, restoration and reconstruction of associated historical features of qualified historical buildings, properties or districts (as defined in Chapter 8-2), and for which Chapters 8-3 through 8-9 of the CHBC may not apply.

**8-1001.2 Scope.** This chapter applies to the associated historical features of qualified historical buildings or properties such as historical districts that are beyond the buildings themselves which include, but are not limited to, natural features and designed site and landscape plans with natural and man-made landscape elements that support their function and aesthetics. This may include, but will not be limited to:

1. Site plan layout configurations and relationships (pedestrian, equestrian and vehicular site circulation, topographical grades and drainage, and use areas).
2. Landscape elements (plant materials, site structures other than the qualified historical building, bridges and their associated structures, lighting, water features, art ornamentation, and pedestrian, equestrian and vehicular surfaces).
3. Functional elements (utility placement, erosion control and environmental mitigation measures).

### SECTION 8-1002 APPLICATION

**8-1002.1** The CHBC shall apply to all sites and districts and their features associated with qualified historical buildings or qualified historical districts as outlined in 8-1001.2 Scope.

**8-1002.2** Where the application of regular code may impact the associated features of qualified historical properties beyond their footprints, by work performed secondarily, those impacts shall also be covered by the CHBC.

**8-1002.3** This chapter shall be applied for all issues regarding code compliance or other standard or regulation as they affect the purpose of this chapter.

**8-1002.4** The application of any code or building standard shall not unduly restrict the use of a qualified historical building or property that is otherwise permitted pursuant to Chapter 8-3 and the intent of the *State Historical Building Code*, Section 18956.

### SECTION 8-1003 SITE RELATIONS

The relationship between a building or property and its site, or the associated features of a district (including qualified historical landscape), site, objects and their features are critical components that may be one of the criteria for these buildings and properties to be qualified under the CHBC. The CHBC recognizes the importance of these relationships. This chapter shall be used to provide context sensitive solutions for treatment of qualified historical buildings, properties, district or their associated historical features, or when work to be performed secondarily impacts the associated historical features of a qualified historical building or property.



# APPENDIX A

## CHAPTER 8-1

When modification must be made to qualified historical buildings and properties, the CHBC is intended to work in conjunction with the United States Secretary of Interior Standards for the Treatment of Historic Properties with Guidelines for Pre-

serving, Rehabilitating, Restoring and Reconstructing Historic Buildings and the Secretary of Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes.

## CHAPTER 8-6

TABLE 1—PROVISION APPLICABILITY

	Title II Public Entities	Title III Private Entities	Title III Barrier Removal
<b>SECTION 8-601 PURPOSE, INTENT, SCOPE</b> <b>8-601.1 Purpose.</b> The purpose of the CHBC is to provide alternative regulations to facilitate access and use by persons with disabilities to and throughout facilities designated as qualified historical buildings or properties. These regulations require enforcing agencies to accept alternatives to regular code when dealing with qualified historical buildings or properties. <b>8-601.2 Intent.</b> The intent of this chapter is to preserve the integrity of qualified historical buildings and properties while providing access to and use by people with disabilities. <b>8-601.3 Scope.</b> The CHBC shall apply to every qualified historical building or property that is required to provide access to people with disabilities. <ol style="list-style-type: none"> <li>Provisions of this chapter do not apply to new construction or reconstruction/replicas of historical buildings.</li> <li>Where provisions of this chapter apply to alteration of qualified historical buildings or properties, alteration is defined in <i>California Building Code</i> (CBC), Chapter 2, Definitions and Abbreviations. 202 – A. Alter or Alteration.</li> </ol> <b>8-601.4 General application.</b> The provisions in the CHBC apply to local, state and federal governments (Title II entities); alteration of commercial facilities and places of public accommodation (Title III entities); and barrier removal in commercial facilities and places of public accommodation (Title III entities). Except as noted in this chapter.	Applies	Applies	Applies
<b>SECTION 8-602 — BASIC PROVISIONS</b> <b>8-602.1 Regular code.</b> The regular code for access for people with disabilities (Title 24, Part 2, Vol.1, Chapter 11B) shall be applied to qualified historical buildings or properties unless strict compliance with the regular code will threaten or destroy the historical significance or character-defining features of the building or property. <b>8-602.2 Alternative provisions.</b> If the historical significance or character-defining features are threatened, alternative provisions for access may be applied pursuant to this chapter, provided the following conditions are met: <ol style="list-style-type: none"> <li>These provisions shall be applied only on an item-by-item or case-by-case basis.</li> <li>Documentation is provided, including meeting minutes or letters, stating the reasons for the application of the alternative provisions. Such documentation shall be retained in the permanent file of the enforcing agency.</li> </ol>	Applies	Applies	Applies

(continued)



TABLE 1—PROVISION APPLICABILITY—continued

	Title II Public Entities	Title III Private Entities	Title III Barrier Removal
<b>SECTION 8-603 — ALTERNATIVES</b>			
<b>8-603.1 Alternative minimum standards.</b> The alternative minimum standards for alterations of qualified historical buildings or facilities are contained in Section 4.1.7(3) of ADA Standards for Accessible Design, as incorporated and set forth in federal regulation 28 C.F.R. Pt. 36.	Applies	Applies	Applies
<b>8-603.2 Entry.</b> These alternatives do not allow exceptions for the requirement of level landings in front of doors, except as provided in Section 8-603.4. <ol style="list-style-type: none"> <li>1. Access to any entrance used by the general public and no further than 200 feet (60 960 mm) from the primary entrance.</li> <li>2. Access at any entrance not used by general public but open and unlocked with directional signs at the primary entrance and as close as possible to, but no further than 200 feet (60 960 mm) from, the primary entrance.</li> <li>3. The accessible entrance shall have a notification system. Where security is a problem, remote monitoring may be used.</li> </ol>	Applies	Applies	Applies
<b>8-603.3 Doors.</b> Alternatives listed in order of priority are: <ol style="list-style-type: none"> <li>1. Single-leaf door which provides a minimum 30 inches (762 mm) of clear opening.</li> <li>2. Single-leaf door which provides a minimum 29½ inches (749 mm) clear opening.</li> <li>3. Double door, one leaf of which provides a minimum 29½ inches (749 mm) clear opening.</li> <li>4. Double doors operable with a power-assist device to provide a minimum 29½ inches (749 mm) clear opening when both doors are in the open position.</li> </ol> <b>Exception:</b> Alternatives in this section do not apply to alteration of commercial facilities and places of public accommodation (Title III entities).	Does not apply	Does not apply	Applies
<b>8-603.4 Power-assisted doors.</b> Power-assisted door or doors may be considered an equivalent alternative to level landings, strikeside clearance and door-opening forces required by regular code.	Applies	Applies	Applies
<b>8-603.5 Toilet rooms.</b> In lieu of separate-gender toilet facilities as required in the regular code, an accessible unisex toilet may be designated.	Applies	Applies	Applies
<b>8-603.6 Exterior and interior ramps and lifts.</b> Alternatives listed in order of priority are: <ol style="list-style-type: none"> <li>1. A lift or a ramp of greater than standard slope but no greater than 1:10, for horizontal distances not to exceed 5 feet (1525 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope.</li> <li>2. Access by ramps of 1:6 slope for horizontal distance not to exceed 13 inches (330 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope.</li> </ol>	Applies	Applies	Applies

(continued)

TABLE 1—PROVISION APPLICABILITY—continued

	Title II Public Entities	Title III Private Entities	Title III Barrier Removal
<p><b>SECTION 8-604 — EQUIVALENT FACILITATION</b></p> <p>Use of other designs and technologies, or deviation from particular technical and scoping requirements, are permitted if the application of the alternative provisions contained in Section 8-603 would threaten or destroy the historical significance or character-defining features of the qualified historical building or property.</p> <ol style="list-style-type: none"> <li>1. Such alternatives shall be applied only on an item-by-item or case-by-case basis.</li> <li>2. Access provided by experiences, services, functions, materials and resources through methods including, but not limited to, maps, plans, videos, virtual reality and related equipment, at accessible levels. The alternative design and/or technologies used will provide substantially equivalent or greater accessibility to, and usability of, the facility.</li> <li>3. The official charged with the enforcement of the standards shall document the reasons for the application of the design and/or technologies and their effect on the historical significance or character-defining features. Such documentation shall be in accordance with Section 8-602.2, Item 2, and shall include the opinion and comments of state or local accessibility officials, and the opinion and comments of representative local groups of people with disabilities. Such documentation shall be retained in the permanent file of the enforcing agency. Copies of the required documentation should be available at the facility upon request.</li> </ol> <p><b>Note:</b> For commercial facilities and places of public accommodation (Title III entities).</p> <p>Equivalent facilitation for an element of a building or property when applied as a waiver of an ADA accessibility requirement will not be entitled to the Federal Department of Justice certification of this code as rebuttable evidence of compliance for that element.</p>	Applies	<p><b>Waivers</b></p> <p>If a builder applies for a waiver of an ADA accessibility requirement for an element of a building, he or she will not be entitled to certification's rebuttable evidence of compliance for that element. This limitation on the certification determination should be noted in any publication of Chapter 8-6 if certification is granted.</p>	Applies

**Notes:** The regular code for Chapter 8-6 is contained in Title 24, Part 2, Vol.1, Chapter 11, which contain standards for new construction. Provisions of this chapter may be used in conjunction with all other provisions of the regular code and ADA regulations.



**HISTORY NOTE APPENDIX**  
***CALIFORNIA HISTORICAL BUILDING CODE***  
**(Title 24, Part 8, California Code of Regulations)**

For prior history, see History Note Appendix to the *California Historical Building Code*, 2010 Triennial Edition, effective January 1, 2011.

1. Editorial correction to Chapter 8-8, Section 8-812, Tables 8-8A and 8-8B. Include missing tables in 2007 annual code adoption supplement.

2. SHBSB 01/10 – Repeal and amend Chapters 8-7 and 8-8 of the 2010 *California Historical Building Code*, CCR, Title 24, Part 8 regulated by the State Historical Building Safety Board, effective on July 1, 2012.

3. Repeal the 2010 *California Historical Building Code*, CCR, Title 24, Part 8 and adopt the 2013 *California Historical Building Code*, CCR, Title 24, Part 8 approved by the Building Standards Commission on December 12, 2012. Published on July 1, 2013 and effective on January 1, 2014.



# CALIFORNIA 2013 EXISTING BUILDING CODE

## California Code of Regulations Title 24, Part 10

California Building Standards Commission  
Based on the 2012 International Existing Building Code®



Effective Date: January 1, 2014  
(For Errata and Supplements, see History Note Appendix)

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California Code of Regulations, Title 24, Part 10

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## PREFACE

This document is part 10 of 12 parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Existing Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must be filed with the California Building Standards Commission to become effective and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

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The 2013 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, the Division of State Architect, the Office of the State Fire Marshal, the Office of Statewide Health Planning and Development, the California Energy Commission, the California Department of Public Health, the California State Lands Commission, the Board of State and Community Corrections, and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

*Governor Edmund G. Brown Jr.*

*Members of the California Building Standards Commission*

*Secretary Anna Caballero – Chair*

*James Barthman – Vice-Chair*

*Stephen Jensen*

*Rose Conroy*

*Randy Twist*

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For questions on California state agency amendments, please refer to the contact list on page v.





# CALIFORNIA CODE OF REGULATIONS, TITLE 24

## California Agency Information Contact List

### Board of State and Community Corrections

www.bscc.ca.gov .....(916) 445-5073  
Local Adult Jail Standards  
Local Juvenile Facility Standards

### California Building Standards Commission

www.bsc.ca.gov .....(916) 263-0916

### California Energy Commission

www.enregy.ca.gov .....**Energy Hotline** (800) 772-3300  
Building Efficiency Standards  
Appliance Efficiency Standards  
Compliance Manual/Forms

### California State Lands Commission

www.slc.ca.gov .....(562) 499-6312  
Marine Oil Terminals

### California State Library

www.library.ca.gov .....(916) 654-0266

### Department of Consumer Affairs:

#### Acupuncture Board

www.acupuncture.ca.gov .....(916) 515-5200  
Office Standards

#### Board of Pharmacy

www.pharmacy.ca.gov .....(916) 574-7900  
Pharmacy Standards

#### Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov .....(916) 952-5210  
Barber and Beauty Shop,  
and College Standards

#### Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation

www.bearhfti.ca.gov .....(916) 999-2041  
Insulation Testing Standards

#### Structural Pest Control Board

www.pestboard.ca.gov .....(800) 737-8188  
Structural Standards

#### Veterinary Medical Board

www.vmb.ca.gov .....(916) 263-2610  
Veterinary Hospital Standards

### Department of Food and Agriculture

www.cdffa.ca.gov  
Meat & Poultry Packing Plant Standards (916) 654-0509  
Dairy Standards (916) 654-0773

### Department of Housing and Community Development

www.hcd.ca.gov .....(916) 445-9471  
Residential- Hotels, Motels, Apartments,  
Single-Family Dwellings; and  
Permanent Structures in Mobilehome &  
Special Occupancy Parks  
(916) 445-3338  
Factory-Built Housing, Manufactured Housing &  
Commercial Modular  
Mobilehome- Permits & Inspections  
Northern Region-(916) 255-2501  
Southern Region-(951) 782-4420  
(916) 445-9471  
Employee Housing Standards

### Department of Public Health

www.dph.ca.gov .....(916) 449-5661  
Organized Camps Standards  
Public Swimming Pools Standards

### Division of the State Architect

www.dgs.ca.gov/dsa. ....(916) 445-8100

#### Access Compliance

#### Structural Safety

Public Schools Standards  
Essential Services Building Standards  
Community College Standards

#### State Historical Building Safety Board

Alternative Building Standards

### Office of Statewide Health Planning and Development

www.oshpd.ca.gov .....(916) 440-8356  
Hospital Standards  
Skilled Nursing Facility Standards &  
Clinic Standards  
Permits

### Office of the State Fire Marshal

osfm.fire.ca.gov .....(916) 445-8200  
Code Development and Analysis  
Fire Safety Standards

# HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

Symbols in the margins indicate where changes have been made or language has been deleted.

|| This symbol indicates that a change has been made.

> This symbol indicates deletion of language.

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## APPENDIX CHAPTER A1 – SEISMIC STRENGTHENING PROVISIONS FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

Adopting Agency		BSC	HCD			DSA							
			1	2	1/AC	AC	SS						
Adopt Entire Chapter													
Adopt Entire Chapter as amended (amended sections listed below)		X	X	X									
Adopt only those sections that are listed below													
Chapter / Section	Codes												
A100	CA	X	X	X									
A103 – BUILDING CODE	CA	X	X	X									

### NOTES:

1. For essential services buildings, refer to Part 1, Chapter 4, Articles 1, 2 and 3, Title 24, C.C.R., for administrative regulations of the Division of the State Architect-Structural Safety Section.
2. For private schools, refer to Education Code section 39160-76 and Health and Safety Code section 18941.5.
3. For historical buildings, refer to Part 8, Title 24, C.C.R.
4. For application and enforcement authority, refer to Part 2, Chapter 1, Div.1, Sections 1.1, 1.2 and 1.8, Title 24, C.C.R.
5. For local jurisdiction exemption program, refer to Health and Safety Code section 18941.6.



# APPENDIX CHAPTER A1

## SEISMIC STRENGTHENING PROVISIONS FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

### SECTION A100 APPLICATION

**A100.1 Vesting authority.** *When adopted by a state agency, the provisions of these regulations shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.*

*Following is a list of the state agencies that adopt building standards, the specific scope of application of the agency responsible for enforcement, and the specific statutory authority of each agency to adopt and enforce such provisions of building standards of this code, unless otherwise stated.*

#### 1. **BSC—California Building Standards Commission.**

*Application—Existing buildings as specified in Section A102 having at least one unreinforced masonry bearing wall, with the exception of buildings subject to building standards pursuant to Health and Safety Code, commencing with Section 17910.*

*Enforcing Agency—State or local agency specified by the applicable provisions of the law.*

*Authority Cited—Health and Safety Code Section 18934.7.*

*Reference—Health and Safety Code Sections 18901 through 18949.*

#### 2. **HCD 1—The Department of Housing and Community Development.**

*Application—Hotels, motels, lodging houses, apartment houses, dwellings, employee housing and factory-built housing.*

*Enforcing Agency—The local building department or the Department of Housing and Community Development.*

*Authority Cited—Health and Safety Code Sections 17040, 17921, 17922 and 19990.*

*Reference—Health and Safety Code Sections 17000 through 17060, 17910 through 17990, 19960 through 19997; and Government Code Section 12955.1.*

#### 3. **HCD 2—The Department of Housing and Community Development.**

*Application—Permanent buildings and permanent accessory buildings or structures constructed within mobilehome parks and special occupancy parks.*

*Enforcing Agency—The local building department or the Department of Housing and Community Development.*

*Authority Cited—Health and Safety Code Sections 18300, 18620, 18640, 18865, 18873 and 18873.2.*

*Reference—Health and Safety Code Sections 18200 through 18700 and 18860 through 18874.*

### SECTION A101 PURPOSE

The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury that may result from the effects of earthquakes on existing unreinforced masonry bearing wall buildings.

The provisions of this chapter are intended as minimum standards for structural seismic resistance, and are established primarily to reduce the risk of life loss or injury. Compliance with these provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to rehabilitated buildings.

### SECTION A102 SCOPE

**A102.1 General.** The provisions of this chapter shall apply to all existing buildings having at least one unreinforced masonry bearing wall. The elements regulated by this chapter shall be determined in accordance with Table A1-A. Except as provided herein, other structural provisions of the building code shall apply. This chapter does not apply to the alteration of existing electrical, plumbing, mechanical or fire safety systems.

**A102.2 Essential and hazardous facilities.** The provisions of this chapter shall not apply to the strengthening of buildings or structures in Occupancy Category III when assigned to Seismic Design Category C, D, or E or buildings or structures in Occupancy Category IV. Such buildings or structures shall be strengthened to meet the requirements of the *California Building Code* for new buildings of the same occupancy category or other such criteria that have been established by the jurisdiction.

### SECTION A103 DEFINITIONS

For the purpose of this chapter, the applicable definitions in the *California Building Code as adopted by the California Building Standards Commission (BSC)* shall also apply:

**BUILDING CODE.** [BSC, HCD 1 and HCD 2] “Building Code” shall mean the most current edition of the *California Building Code, Title 24, Part 2 as adopted by the California Building Standards Commission (BSC)*.

**COLLAR JOINT.** The vertical space between adjacent wythes. A collar joint may contain mortar or grout.



**CROSSWALL.** A new or existing wall that meets the requirements of Section A111.3 and the definition of Section A111.3. A crosswall is not a shear wall.

**CROSSWALL SHEAR CAPACITY.** The unit shear value times the length of the crosswall,  $v_c L_c$ .

**DIAPHRAGM EDGE.** The intersection of the horizontal diaphragm and a shear wall.

**DIAPHRAGM SHEAR CAPACITY.** The unit shear value times the depth of the diaphragm,  $v_u D$ .

**NORMAL WALL.** A wall perpendicular to the direction of seismic forces.

**OPEN FRONT.** An exterior building wall line without vertical elements of the lateral-force-resisting system in one or more stories.

**POINTING.** The partial reconstruction of the bed joints of an unreinforced masonry wall as defined in UBC Standard 21-8.

**RIGID DIAPHRAGM.** A diaphragm of reinforced concrete construction supported by concrete beams and columns or by structural steel beams and columns.

**UNREINFORCED MASONRY.** Includes burned clay, concrete or sand-lime brick; hollow clay or concrete block; plain concrete; and hollow clay tile. These materials shall comply with the requirements of Section A106 as applicable.

**UNREINFORCED MASONRY BEARING WALL.** A URM wall that provides the vertical support for the reaction of floor or roof-framing members.

**UNREINFORCED MASONRY (URM) WALL.** A masonry wall that relies on the tensile strength of masonry units, mortar and grout in resisting design loads, and in which the area of reinforcement is less than 25 percent of the minimum ratio required by the building code for reinforced masonry.

**YIELD STORY DRIFT.** The lateral displacement of one level relative to the level above or below at which yield stress is first developed in a frame member.

## SECTION A104 SYMBOLS AND NOTATIONS

For the purpose of this chapter, the following notations supplement the applicable symbols and notations in the building code.

$a_n$	= Diameter of core multiplied by its length or the area of the side of a square prism.	$f'_m$	= Compressive strength of masonry.
$A$	= Cross-sectional area of unreinforced masonry pier or wall, square inches ( $10^{-6}$ m <sup>2</sup> ).	$f_{sp}$	= Tensile-splitting strength of masonry.
$A_b$	= Total area of the bed joints above and below the test specimen for each in-place shear test, square inches ( $10^{-6}$ m <sup>2</sup> ).	$F_{wx}$	= Force applied to a wall at level $x$ , pounds (N).
$D$	= In-plane width dimension of pier, inches ( $10^{-3}$ m), or depth of diaphragm, feet (m).	$H$	= Least clear height of opening on either side of a pier, inches ( $10^{-3}$ m).
$DCR$	= Demand-capacity ratio specified in Section A111.4.2.	$h/t$	= Height-to-thickness ratio of URM wall. Height, $h$ , is measured between wall anchorage levels and/or slab-on-grade.
		$L$	= Span of diaphragm between shear walls, or span between shear wall and open front, feet (m).
		$L_c$	= Length of crosswall, feet (m).
		$L_i$	= Effective span for an open-front building specified in Section A111.8, feet (m).
		$P$	= Applied force as determined by standard test method of ASTM C 496 or ASTM E 519, pounds (N).
		$P_D$	= Superimposed dead load at the location under consideration, pounds (kN). For determination of the rocking shear capacity, dead load at the top of the pier under consideration shall be used.
		$p_{D+L}$	= Press resulting from the dead plus actual live load in place at the time of testing, pounds per square inch (kPa).
		$P_w$	= Weight of wall, pounds (N).
		$R$	= Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE 7, where $R = 1.5$ .
		$S_{DS}$	= Design spectral acceleration at short period, in g units.
		$S_{D1}$	= Design spectral acceleration at 1-second period, in g units.
		$v_a$	= The shear strength of any URM pier, $v_m A/1.5$ pounds (N).
		$v_c$	= Unit shear capacity value for a crosswall sheathed with any of the materials given in Table A1-D or A1-E, pounds per foot (N/m).
		$v_m$	= Shear strength of unreinforced masonry, pounds per square inch (kPa).
		$V_a$	= The shear strength of any URM pier or wall, pounds (N).
		$V_{ca}$	= Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, $v_c L_c$ , pounds (N).
		$V_{cb}$	= Total shear capacity of crosswalls in the direction of analysis immediately below the diaphragm level being investigated, $v_c L_c$ , pounds (N).
		$V_p$	= Shear force assigned to a pier on the basis of its relative shear rigidity, pounds (N).
		$V_r$	= Pier rocking shear capacity of any URM wall or wall pier, pounds (N).

- $v_t$  = Mortar shear strength as specified in Section A106.3.3.5, pounds per square inch (kPa).
- $V_{test}$  = Load at incipient cracking for each in-place shear test per UBC Standard 21-6, pounds (kN).
- $v_{to}$  = Mortar shear test values as specified in Section A106.3.3.5, pounds per square inch (kPa).
- $v_u$  = Unit shear capacity value for a diaphragm sheathed with any of the materials given in Table A1-D or A1-E, pounds per foot (N/m).
- $V_{wx}$  = Total shear force resisted by a shear wall at the level under consideration, pounds (N).
- $W$  = Total seismic dead load as defined in the building code, pounds (N).
- $W_d$  = Total dead load tributary to a diaphragm level, pounds (N).
- $W_w$  = Total dead load of a URM wall above the level under consideration or above an open-front building, pounds (N).
- $W_{wx}$  = Dead load of a URM wall assigned to level  $x$  half-way above and below the level under consideration, pounds (N).
- $\sum v_u D$  = Sum of diaphragm shear capacities of both ends of the diaphragm, pounds (N).
- $\sum \sum v_u D$  = For diaphragms coupled with crosswalls,  $v_u D$  includes the sum of shear capacities of both ends of diaphragms coupled at and above the level under consideration, pounds (N).
- $\sum W_d$  = Total dead load of all the diaphragms at and above the level under consideration, pounds (N).

## SECTION A105 GENERAL REQUIREMENTS

**A105.1 General.** The seismic-force-resisting system specified in this chapter shall comply with the building code, except as modified herein.

**A105.2 Alterations and repairs.** Alterations and repairs required to meet the provisions of this chapter shall comply with applicable structural requirements of the building code unless specifically provided for in this chapter.

**A105.3 Requirements for plans.** The following construction information shall be included in the plans required by this chapter:

1. Dimensioned floor and roof plans showing existing walls and the size and spacing of floor and roof-framing members and sheathing materials. The plans shall indicate all existing and new crosswalls and shear walls and their materials of construction. The location of these walls and their openings shall be fully dimensioned and drawn to scale on the plans.
2. Dimensioned wall elevations showing openings, piers, wall classes as defined in Section A106.3.3.8, thickness, heights, wall shear test locations, cracks or damaged portions requiring repairs, the general condition of the mortar joints, and if and where pointing is required. Where

the exterior face is veneer, the type of veneer, its thickness and its bonding and/or ties to the structural wall masonry shall also be noted.

3. The type of interior wall and ceiling materials, and framing.
4. The extent and type of existing wall anchorage to floors and roof when used in the design.
5. The extent and type of parapet corrections that were previously performed, if any.
6. Repair details, if any, of cracked or damaged unreinforced masonry walls required to resist forces specified in this chapter.
7. All other plans, sections and details necessary to delineate required retrofit construction.
8. The design procedure used shall be stated on both the plans and the permit application.
9. Details of the anchor prequalification program required by UBC Standard 21-7, if used, including location and results of all tests.

### A105.4 Structural observation, testing and inspection.

Structural observation, in accordance with Section 1709 of the *California Building Code*, shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. Structural observation shall include visual observation of work for conformance with the approved construction documents and confirmation of existing conditions assumed during design.

Structural testing and inspection for new construction materials shall be in accordance with the *California Building Code*, except as modified by this chapter.

## SECTION A106 MATERIALS REQUIREMENTS

**A106.1 General.** Materials permitted by this chapter, including their appropriate strength design values and those existing configurations of materials specified herein, may be used to meet the requirements of this chapter.

**A106.2 Existing materials.** Existing materials used as part of the required vertical-load-carrying or lateral-force-resisting system shall be in sound condition, or shall be repaired or removed and replaced with new materials. All other unreinforced masonry materials shall comply with the following requirements:

1. The lay-up of the masonry units shall comply with Section A106.3.2, and the quality of bond between the units has been verified to the satisfaction of the building official;
2. Concrete masonry units are verified to be load-bearing units complying with UBC Standard 21-4 or such other standard as is acceptable to the building official; and
3. The compressive strength of plain concrete walls shall be determined based on cores taken from each class of concrete wall. The location and number of tests shall be the same as those prescribed for tensile-splitting strength

tests in Sections A106.3.3.3 and A106.3.3.4, or in Section A108.1.

The use of materials not specified herein or in Section A108.1 shall be based on substantiating research data or engineering judgment, with the approval of the building official.

### A106.3 Existing unreinforced masonry.

**A106.3.1 General.** Unreinforced masonry walls used to carry vertical loads or seismic forces parallel and perpendicular to the wall plane shall be tested as specified in this section. All masonry that does not meet the minimum standards established by this chapter shall be removed and replaced with new materials, or alternatively, shall have its structural functions replaced with new materials and shall be anchored to supporting elements.

#### A106.3.2 Lay-up of walls.

**A106.3.2.1 Multiwythe solid brick.** The facing and backing shall be bonded so that not less than 10 percent of the exposed face area is composed of solid headers extending not less than 4 inches (102 mm) into the backing. The clear distance between adjacent full-length headers shall not exceed 24 inches (610 mm) vertically or horizontally. Where the backing consists of two or more wythes, the headers shall extend not less than 4 inches (102 mm) into the most distant wythe, or the backing wythes shall be bonded together with separate headers with their area and spacing conforming to the foregoing. Wythes of walls not bonded as described above shall be considered veneer. Veneer wythes shall not be included in the effective thickness used in calculating the height-to-thickness ratio and the shear capacity of the wall.

**Exception:** Veneer wythes anchored as specified in the building code and made composite with backup masonry may be used for calculation of the effective thickness, where  $S_{Dr}$  exceeds 0.3.

**A106.3.2.2 Grouted or ungrouted hollow concrete or clay block and structural hollow clay tile.** Grouted or ungrouted hollow concrete or clay block and structural hollow clay tile shall be laid in a running bond pattern.

**A106.3.2.3 Other lay-up patterns.** Lay-up patterns other than those specified in Sections A106.3.2.1 and A106.3.2.2 above are allowed if their performance can be justified.

#### A106.3.3 Testing of masonry.

**A106.3.3.1 Mortar tests.** The quality of mortar in all masonry walls shall be determined by performing in-place shear tests in accordance with the following:

1. The bed joints of the outer wythe of the masonry should be tested in shear by laterally displacing a single brick relative to the adjacent bricks in the same wythe. The head joint opposite the loaded end of the test brick should be carefully excavated and cleared. The brick adjacent to the loaded end of the test brick should be carefully removed by sawing or drilling and excavating to provide space for a hydraulic ram and steel loading blocks. Steel

blocks, the size of the end of the brick, should be used on each end of the ram to distribute the load to the brick. The blocks should not contact the mortar joints. The load should be applied horizontally, in the plane of the wythe. The load recorded at first movement of the test brick as indicated by spalling of the face of the mortar bed joints is  $V_{test}$  in Equation (A1-3).

2. Alternative procedures for testing shall be used where in-place testing is not practical because of crushing or other failure mode of the masonry unit (see Section A106.3.3.2).

**A106.3.3.2 Alternative procedures for testing masonry.** The tensile-splitting strength of existing masonry,  $f_{sp}$ , or the prism strength of existing masonry,  $f'_m$  may be determined in accordance with one of the following procedures:

1. Wythes of solid masonry units shall be tested by sampling the masonry by drilled cores of not less than 8 inches (203 mm) in diameter. A bed joint intersection with a head joint shall be in the center of the core. The tensile-splitting strength of these cores should be determined by the standard test method of ASTM C 496. The core should be placed in the test apparatus with the bed joint 45 degrees from the horizontal. The tensile-splitting strength should be determined by the following equation:

$$f_{sp} = \frac{2P}{\pi a_n} \quad \text{(Equation A1-1)}$$

2. Hollow unit masonry constructed of through-the-wall units shall be tested by sampling the masonry by a sawn square prism of not less than 18 inches square (11 613 mm<sup>2</sup>). The tensile-splitting strength should be determined by the standard test method of ASTM E 519. The diagonal of the prism should be placed in a vertical position. The tensile-splitting strength should be determined by the following equation:

$$f_{sp} = \frac{0.494P}{a_n} \quad \text{(Equation A1-2)}$$

3. An alternative to material testing is estimation of the  $f'_m$  of the existing masonry. This alternative should be limited to recently constructed masonry. The determination of  $f'_m$  requires that the unit correspond to a specification of the unit by an ASTM standard and classification of the mortar by type.

**A106.3.3.3 Location of tests.** The shear tests shall be taken at locations representative of the mortar conditions throughout the entire building, taking into account variations in workmanship at different building height levels, variations in weathering of the exterior surfaces, and variations in the condition of the interior surfaces due to deterioration caused by leaks and condensation of water and/or by the deleterious effects of other substances con-

tained within the building. The exact test locations shall be determined at the building site by the engineer or architect in responsible charge of the structural design work. An accurate record of all such tests and their locations in the building shall be recorded, and these results shall be submitted to the building department for approval as part of the structural analysis.

**A106.3.3.4 Number of tests.** The minimum number of tests per class shall be as follows:

1. At each of both the first and top stories, not less than two tests per wall or line of wall elements providing a common line of resistance to lateral forces.
2. At each of all other stories, not less than one test per wall or line of wall elements providing a common line of resistance to lateral forces.
3. In any case, not less than one test per 1,500 square feet (139.4 m<sup>2</sup>) of wall surface and not less than a total of eight tests.

**A106.3.3.5 Minimum quality of mortar.**

1. Mortar shear test values,  $v_{io}$ , in pounds per square inch (kPa) shall be obtained for each in-place shear test in accordance with the following equation:

$$v_{io} = (V_{test}/A_b) - p_{D+L} \quad \text{(Equation A1-3)}$$

2. Individual unreinforced masonry walls with  $v_{io}$  consistently less than 30 pounds per square inch (207 kPa) shall be entirely pointed prior to retesting.
3. The mortar shear strength,  $v_r$ , is the value in pounds per square inch (kPa) that is exceeded by 80 percent of the mortar shear test values,  $v_{io}$ .
4. Unreinforced masonry with mortar shear strength,  $v_r$ , less than 30 pounds per square inch (207 kPa) shall be removed, pointed and retested or shall have its structural function replaced, and shall be anchored to supporting elements in accordance with Sections A106.3.1 and A113.8. When existing mortar in any wythe is pointed to increase its shear strength and is retested, the condition of the mortar in the adjacent bed joints of the inner wythe or wythes and the opposite outer wythe shall be examined for extent of deterioration. The shear strength of any wall class shall be no greater than that of the weakest wythe of that class.

**A106.3.3.6 Minimum quality of masonry.**

1. The minimum average value of tensile-splitting strength determined by Equation (A1-1) or (A1-2) shall be 50 pounds per square inch (344.7 kPa). The minimum value of  $f'_m$  determined by categorization of the masonry units and mortar should be 1,000 pounds per square inch (6895 kPa).
2. Individual unreinforced masonry walls with average tensile-splitting strength of less than 50 pounds per square inch (344.7 kPa) shall be entirely pointed prior to retesting.

3. Hollow unit unreinforced masonry walls with estimated prism compressive strength of less than 1,000 pounds per square inch (6895 kPa) shall be grouted to increase the average net area compressive strength.

**A106.3.3.7 Collar joints.** The collar joints shall be inspected at the test locations during each in-place shear test, and estimates of the percentage of adjacent wythe surfaces that are covered with mortar shall be reported along with the results of the in-place shear tests.

**A106.3.3.8 Unreinforced masonry classes.** Existing unreinforced masonry shall be categorized into one or more classes based on shear strength, quality of construction, state of repair, deterioration and weathering. A class shall be characterized by the allowable masonry shear stress determined in accordance with Section A108.2. Classes shall be defined for whole walls, not for small areas of masonry within a wall.

**A106.3.3.9 Pointing.** Deteriorated mortar joints in unreinforced masonry walls shall be pointed according to UBC Standard 21-8. Nothing shall prevent pointing of any deteriorated masonry wall joints before the tests are made, except as required in Section A107.1.

## SECTION A107 QUALITY CONTROL

**A107.1 Pointing.** Preparation and mortar pointing shall be performed with special inspection.

**Exception:** At the discretion of the building official, incidental pointing may be performed without special inspection.

**A107.2 Masonry shear tests.** In-place masonry shear tests shall comply with Section A106.3.3.1. Testing of masonry for determination of tensile-splitting strength shall comply with Section A106.3.3.2.

**A107.3 Existing wall anchors.** Existing wall anchors used as all or part of the required tension anchors shall be tested in pull-out according to UBC Standard 21-7. The minimum number of anchors tested shall be four per floor, with two tests at walls with joists framing into the wall and two tests at walls with joists parallel to the wall, but not less than 10 percent of the total number of existing tension anchors at each level.

**A107.4 New bolts.** All new embedded bolts shall be subject to periodic special inspection in accordance with the building code, prior to placement of the bolt and grout or adhesive in the drilled hole. Five percent of all bolts that do not extend through the wall shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with UBC Standard 21-7. New bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

**Exception:** Special inspection in accordance with the building code may be provided during installation of new anchors in lieu of testing.



All new embedded bolts resisting tension forces or a combination of tension and shear forces shall be subject to periodic special inspection in accordance with the building code, prior to placement of the bolt and grout or adhesive in the drilled hole. Five percent of all bolts resisting tension forces shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with UBC Standard 21-7. New through-bolts need not be tested.

## SECTION A108 DESIGN STRENGTHS

### A108.1 Values.

1. Strength values for existing materials are given in Table A1-D and for new materials in Table A1-E.
2. Capacity reduction factors need not be used.
3. The use of new materials not specified herein shall be based on substantiating research data or engineering judgment, with the approval of the building official.

**A108.2 Masonry shear strength.** The unreinforced masonry shear strength,  $v_m$ , shall be determined for each masonry class from one of the following equations:

1. The unreinforced masonry shear strength,  $v_m$ , shall be determined by Equation (A1-4) when the mortar shear strength has been determined by Section A106.3.3.1.

$$v_m = 0.56v_t + \frac{0.75P_D}{A} \quad (\text{Equation A1-4})$$

The mortar shear strength values,  $v_t$ , shall be determined in accordance with Section 106.3.3.5 and shall not exceed 100 pounds per square inch (689.5 kPa) for the determination of  $v_m$ .

2. The unreinforced masonry shear,  $v_m$ , shall be determined by Equation (A1-5) when tensile-splitting strength has been determined in accordance with Section A106.3.3.2, Item 1 or 2.

$$v_m = 0.8f_{sp} + 0.5\frac{P_D}{A} \quad (\text{Equation A1-5})$$

3. When  $f'_m$  has been estimated by categorization of the units and mortar in accordance with Section 2105.2.2.1 of the *California Building Code*, the unreinforced masonry shear strength,  $v_m$ , shall not exceed 200 pounds per square inch (1380 kPa) or the lesser of the following:

a)  $2.5\sqrt{f'_m}$  or

b) 200 psi or

c)  $v + 0.75\frac{P_D}{A}$  (Equation A1-6)

For SI: 1 psi = 6.895 kPa.

where:

$v$  = 62.5 psi (430 kPa) for running bond masonry not grouted solid.

$v$  = 100 psi (690 kPa) for running bond masonry grouted solid.

$v$  = 25 psi (170 kPa) for stack bond grouted solid.

**A108.3 Masonry compression.** Where any increase in dead plus live compression stress occurs, the compression stress in unreinforced masonry shall not exceed 300 pounds per square inch (2070 kPa).

**A108.4 Masonry tension.** Unreinforced masonry shall be assumed to have no tensile capacity.

**A108.5 Existing tension anchors.** The resistance values of the existing anchors shall be the average of the tension tests of existing anchors having the same wall thickness and joist orientation.

**A108.6 Foundations.** For existing foundations, new total dead loads may be increased over the existing dead load by 25 percent. New total dead load plus live load plus seismic forces may be increased over the existing dead load plus live load by 50 percent. Higher values may be justified only in conjunction with a geotechnical investigation.

## SECTION A109 ANALYSIS AND DESIGN PROCEDURE

**A109.1 General.** The elements of buildings hereby required to be analyzed are specified in Table A1-A.

**A109.2 Selection of procedure.** Buildings with rigid diaphragms shall be analyzed by the general procedure of Section A110, which is based on the building code. Buildings with flexible diaphragms shall be analyzed by the general procedure or, when applicable, may be analyzed by the special procedure of Section A111.

## SECTION A110 GENERAL PROCEDURE

**A110.1 Minimum design lateral forces.** Buildings shall be analyzed to resist minimum lateral forces assumed to act non-concurrently in the direction of each of the main axes of the structure in accordance with the following:

$$V = \frac{0.75 S_{DS} W}{R} \quad (\text{Equation A1-7})$$

**A110.2 Lateral forces on elements of structures.** Parts and portions of a structure not covered in Sections A110.3 shall be analyzed and designed per the current building code, using force levels defined in Section A110.1.

### Exceptions:

1. Unreinforced masonry walls for which height-to-thickness ratios do not exceed ratios set forth in Table A1-B need not be analyzed for out-of-plane loading. Unreinforced masonry walls that exceed the allowable  $h/t$  ratios of Table A1-B shall be braced according to Section A113.5.
2. Parapets complying with Section A113.6 need not be analyzed for out-of-plane loading.

3. Walls shall be anchored to floor and roof diaphragms in accordance with Section A113.1.

**A110.3 In-plane loading of URM shear walls and frames.** Vertical lateral-load-resisting elements shall be analyzed in accordance with Section A112.

**A110.4 Redundancy and overstrength factors.** Any redundancy or overstrength factors contained in the building code may be taken as unity. The vertical component of earthquake load ( $E_v$ ) may be taken as zero.

## SECTION A111 SPECIAL PROCEDURE

**A111.1 Limits for the application of this procedure.** The special procedures of this section may be applied only to buildings having the following characteristics:

1. Flexible diaphragms at all levels above the base of the structure.
2. Vertical elements of the lateral-force-resisting system consisting predominantly of masonry or concrete shear walls.
3. Except for single-story buildings with an open front on one side only, a minimum of two lines of vertical elements of the lateral-force-resisting system parallel to each axis of the building (see Section A111.8 for open-front buildings).

**A111.2 Lateral forces on elements of structures.** With the exception of the provisions in Sections A111.4 through A111.7, elements of structures shall comply with Sections A110.2 through A110.4.

**A111.3 Crosswalls.** Crosswalls shall meet the requirements of this section.

**A111.3.1 Crosswall definition.** A crosswall is a wood-framed wall sheathed with any of the materials described in Table A1-D or A1-E or other system as defined in Section A111.3.5. Crosswalls shall be spaced no more than 40 feet (12 192 mm) on center measured perpendicular to the direction of consideration, and shall be placed in each story of the building. Crosswalls shall extend the full story height between diaphragms.

### Exceptions:

1. Crosswalls need not be provided at all levels when used in accordance with Section A111.4.2, Item 4.
2. Existing crosswalls need not be continuous below a wood diaphragm at or within 4 feet (1219 mm) of grade, provided:
  - 2.1 Shear connections and anchorage requirements of Section A111.5 are satisfied at all edges of the diaphragm.
  - 2.2 Crosswalls with total shear capacity of  $0.5S_{D1}\sum W_d$  interconnect the diaphragm to the foundation.
  - 2.3 The demand-capacity ratio of the diaphragm between the crosswalls that are

continuous to their foundations does not exceed 2.5, calculated as follows:

$$DCR = \frac{(2.1S_{D1}W_d + V_{ca})}{2v_u D} \quad (\text{Equation A1-8})$$

**A111.3.2 Crosswall shear capacity.** Within any 40 feet (12 192 mm) measured along the span of the diaphragm, the sum of the crosswall shear capacities shall be at least 30 percent of the diaphragm shear capacity of the strongest diaphragm at or above the level under consideration.

**A111.3.3 Existing crosswalls.** Existing crosswalls shall have a maximum height-to-length ratio between openings of 1.5 to 1. Existing crosswall connections to diaphragms need not be investigated as long as the crosswall extends to the framing of the diaphragms above and below.

**A111.3.4 New crosswalls.** New crosswall connections to the diaphragm shall develop the crosswall shear capacity. New crosswalls shall have the capacity to resist an overturning moment equal to the crosswall shear capacity times the story height. Crosswall overturning moments need not be cumulative over more than two stories.

**A111.3.5 Other crosswall systems.** Other systems, such as moment-resisting frames, may be used as crosswalls provided that the yield story drift does not exceed 1 inch (25.4 mm) in any story.

### A111.4 Wood diaphragms.

**A111.4.1 Acceptable diaphragm span.** A diaphragm is acceptable if the point ( $L, DCR$ ) on Figure A1-1 falls within Region 1, 2 or 3.

**A111.4.2 Demand-capacity ratios.** Demand-capacity ratios shall be calculated for the diaphragm at any level according to the following formulas:

1. For a diaphragm without qualifying crosswalls at levels immediately above or below:

$$DCR = 2.1 S_{D1} W_d / \sum v_u D \quad (\text{Equation A1-9})$$

2. For a diaphragm in a single-story building with qualifying crosswalls, or for a roof diaphragm coupled by crosswalls to the diaphragm directly below:

$$DCR = 2.1 S_{D1} W_d / (\sum v_u D + V_{cb}) \quad (\text{Equation A1-10})$$

3. For diaphragms in a multistory building with qualifying crosswalls in all levels:

$$DCR = 2.1 S_{D1} \sum W_d / (\sum \sum v_u D + V_{cb}) \quad (\text{Equation A1-11})$$

$DCR$  shall be calculated at each level for the set of diaphragms at and above the level under consideration. In addition, the roof diaphragm shall also meet the requirements of Equation (A1-10).

4. For a roof diaphragm and the diaphragm directly below, if coupled by crosswalls:

$$DCR = 2.1 S_{D1} \sum W_d / \sum \sum v_u D \quad (\text{Equation A1-12})$$

**A111.4.3 Chords.** An analysis for diaphragm flexure need not be made, and chords need not be provided.

**A111.4.4 Collectors.** An analysis of diaphragm collector forces shall be made for the transfer of diaphragm edge shears into vertical elements of the lateral-force-resisting system. Collector forces may be resisted by new or existing elements.

**A111.4.5 Diaphragm openings.**

1. Diaphragm forces at corners of openings shall be investigated and shall be developed into the diaphragm by new or existing materials.
2. In addition to the demand-capacity ratios of Section A111.4.2, the demand-capacity ratio of the portion of the diaphragm adjacent to an opening shall be calculated using the opening dimension as the span.
3. Where an opening occurs in the end quarter of the diaphragm span, the calculation of  $v_u D$  for the demand-capacity ratio shall be based on the net depth of the diaphragm.

**A111.5 Diaphragm shear transfer.** Diaphragms shall be connected to shear walls with connections capable of developing the diaphragm-loading tributary to the shear wall given by the lesser of the following formulas:

$$V = 1.2 S_{D1} C_p W_d \quad (\text{Equation A1-13})$$

using the  $C_p$  values in Table A1-C, or

$$V = v_u D \quad (\text{Equation A1-14})$$

**A111.6 Shear walls (In-plane loading).**

**A111.6.1 Wall story force.** The wall story force distributed to a shear wall at any diaphragm level shall be the lesser value calculated as:

$$F_{wx} = 0.8 S_{D1} (W_{wx} + W_d/2) \quad (\text{Equation A1-15})$$

but need not exceed

$$F_{wx} = 0.8 S_{D1} W_{wx} + v_u D \quad (\text{Equation A1-16})$$

**A111.6.2 Wall story shear.** The wall story shear shall be the sum of the wall story forces at and above the level of consideration.

$$V_{wx} = F_{wx} \quad (\text{Equation A1-17})$$

**A111.6.3 Shear wall analysis.** Shear walls shall comply with Section A112.

**A111.6.4 Moment frames.** Moment frames used in place of shear walls shall be designed as required by the building code, except that the forces shall be as specified in Section A111.6.1, and the story drift ratio shall be limited to 0.015, except as further limited by Section A112.4.2.

**A111.7 Out-of-plane forces—unreinforced masonry walls.**

**A111.7.1 Allowable unreinforced masonry wall height-to-thickness ratios.** The provisions of Section A110.2 are applicable, except the allowable height-to-thickness ratios given in Table A1-B shall be determined from Figure A1-1 as follows:

1. In Region 1, height-to-thickness ratios for buildings with crosswalls may be used if qualifying crosswalls are present in all stories.

2. In Region 2, height-to-thickness ratios for buildings with crosswalls may be used whether or not qualifying crosswalls are present.

3. In Region 3, height-to-thickness ratios for “all other buildings” shall be used whether or not qualifying crosswalls are present.

**A111.7.2 Walls with diaphragms in different regions.**

When diaphragms above and below the wall under consideration have demand-capacity ratios in different regions of Figure A1-1, the lesser height-to-thickness ratio shall be used.

**A111.8 Open-front design procedure.** A single-story building with an open front on one side and crosswalls parallel to the open front may be designed by the following procedure:

1. Effective diaphragm span,  $L_i$ , for use in Figure A1-1 shall be determined in accordance with the following formula:

$$L_i = 2 [(W_w/W_d) L + L] \quad (\text{Equation A1-18})$$

2. Diaphragm demand-capacity ratio shall be calculated as:

$$DCR = 2.12 S_{D1} (W_d + W_w) / [(v_u D) + V_{cb}] \quad (\text{Equation A1-19})$$

## SECTION A112 ANALYSIS AND DESIGN

**A112.1 General.** The following requirements are applicable to both the general procedure and the special procedure for analyzing vertical elements of the lateral-force-resisting system.

**A112.2 Existing unreinforced masonry walls.**

**A112.2.1 Flexural rigidity.** Flexural components of deflection may be neglected in determining the rigidity of an unreinforced masonry wall.

**A112.2.2 Shear walls with openings.** Wall piers shall be analyzed according to the following procedure, which is diagrammed in Figure A1-2.

1. For any pier,
  - 1.1. The pier shear capacity shall be calculated as:

$$V_a = v_m A / 1.5 \quad (\text{Equation A1-20})$$

- 1.2. The pier rocking shear capacity shall be calculated as:

$$V_r = 0.9 P_D H / H \quad (\text{Equation A1-21})$$

2. The wall piers at any level are acceptable if they comply with one of the following modes of behavior:

- 2.1. Rocking controlled mode. When the pier rocking shear capacity is less than the pier shear capacity, i.e.,  $V_r < V_a$  for each pier in a level, forces in the wall at that level,  $V_{wx}$ , shall be distributed to each pier in proportion to  $P_D H / H$ .

For the wall at that level:

$$0.7 V_{wx} < \sum V_r \quad (\text{Equation A1-22})$$

- 2.2. Shear controlled mode. Where the pier shear capacity is less than the pier rocking capacity, i.e.,  $V_a < V_r$  in at least one pier in a level, forces in the wall at the level,  $V_{wx}$ , shall be distributed to each pier in proportion to  $D/H$ .

For each pier at that level:

$$V_p < V_a \quad (\text{Equation A1-23})$$

and

$$V_p < V_r \quad (\text{Equation A1-24})$$

If  $V_p < V_a$  for each pier and  $V_p > V_r$  for one or more piers, such piers shall be omitted from the analysis, and the procedure shall be repeated for the remaining piers, unless the wall is strengthened and reanalyzed.

3. **Masonry pier tension stress.** Unreinforced masonry wall piers need not be analyzed for tension stress.

**A112.2.3 Shear walls without openings.** Shear walls without openings shall be analyzed the same as for walls with openings, except that  $V_r$  shall be calculated as follows:

$$V_r = 0.9 (P_D + 0.5 P_w) D/H \quad (\text{Equation A1-25})$$

**A112.3 Plywood-sheathed shear walls.** Plywood-sheathed shear walls may be used to resist lateral forces for buildings with flexible diaphragms analyzed according to provisions of Section A111. Plywood-sheathed shear walls may not be used to share lateral forces with other materials along the same line of resistance.

#### A112.4 Combinations of vertical elements.

**A112.4.1 Lateral-force distribution.** Lateral forces shall be distributed among the vertical-resisting elements in proportion to their relative rigidities, except that moment-resisting frames shall comply with Section A112.4.2.

**A112.4.2 Moment-resisting frames.** Moment-resisting frames shall not be used with an unreinforced masonry wall in a single line of resistance unless the wall has piers that have adequate shear capacity to sustain rocking in accordance with Section A112.2.2. The frames shall be designed in accordance with the building code to carry 100 percent of the lateral forces tributary to that line of resistance, as determined from Equation (A1-7). The story drift ratio shall be limited to 0.0075.

### SECTION A113 DETAILED SYSTEM DESIGN REQUIREMENTS

#### A113.1 Wall anchorage.

**A113.1.1 Anchor locations.** Unreinforced masonry walls shall be anchored at the roof and floor levels as required in Section A110.2. Ceilings of plaster or similar materials, when not attached directly to roof or floor framing and where abutting masonry walls, shall either be anchored to the walls at a maximum spacing of 6 feet (1829 mm), or be removed.

**A113.1.2 Anchor requirements.** Anchors shall consist of bolts installed through the wall as specified in Table A1-E, or an approved equivalent at a maximum anchor spacing of

6 feet (1829 mm). All wall anchors shall be secured to the joists to develop the required forces.

**A113.1.3 Minimum wall anchorage.** Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as  $0.9S_{DS}$  times the tributary weight or 200 pounds per linear foot (2920 N/m), whichever is greater, acting normal to the wall at the level of the floor or roof. Existing wall anchors, if used, must meet the requirements of this chapter or must be upgraded.

**A113.1.4 Anchors at corners.** At the roof and floor levels, both shear and tension anchors shall be provided within 2 feet (610 mm) horizontally from the inside of the corners of the walls.

**A113.2 Diaphragm shear transfer.** Bolts transmitting shear forces shall have a maximum bolt spacing of 6 feet (1829 mm) and shall have nuts installed over malleable iron or plate washers when bearing on wood, and heavy-cut washers when bearing on steel.

**A113.3 Collectors.** Collector elements shall be provided that are capable of transferring the seismic forces originating in other portions of the building to the element providing the resistance to those forces.

**A113.4 Ties and continuity.** Ties and continuity shall conform to the requirements of the building code.

#### A113.5 Wall bracing.

**A113.5.1 General.** Where a wall height-to-thickness ratio exceeds the specified limits, the wall may be laterally supported by vertical bracing members per Section A113.5.2 or by reducing the wall height by bracing per Section A113.5.3.

**A113.5.2 Vertical bracing members.** Vertical bracing members shall be attached to floor and roof construction for their design loads independently of required wall anchors. Horizontal spacing of vertical bracing members shall not exceed one-half of the unsupported height of the wall or 10 feet (3048 mm). Deflection of such bracing members at design loads shall not exceed one-tenth of the wall thickness.

**A113.5.3 Intermediate wall bracing.** The wall height may be reduced by bracing elements connected to the floor or roof. Horizontal spacing of the bracing elements and wall anchors shall be as required by design, but shall not exceed 6 feet (1829 mm) on center. Bracing elements shall be detailed to minimize the horizontal displacement of the wall by the vertical displacement of the floor or roof.

**A113.6 Parapets.** Parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions.

The maximum height of an unbraced unreinforced masonry parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table A1-F. If the required parapet height exceeds this maximum height, a bracing system designed for the forces determined in accordance with the building code shall support the top of the parapet. Parapet corrective work



must be performed in conjunction with the installation of tension roof anchors.

The minimum height of a parapet above any wall anchor shall be 12 inches (305 mm).

**Exception:** If a reinforced concrete beam is provided at the top of the wall, the minimum height above the wall anchor may be 6 inches (152 mm).

#### A113.7 Veneer.

1. Veneer shall be anchored with approved anchor ties conforming to the required design capacity specified in the building code and shall be placed at a maximum spacing of 24 inches (610 mm) with a maximum supported area of 4 square feet (0.372 m<sup>2</sup>).

**Exception:** Existing anchor ties for attaching brick veneer to brick backing may be acceptable, provided the ties are in good condition and conform to the following minimum size and material requirements.

Existing veneer anchor ties may be considered adequate if they are of corrugated galvanized iron strips not less than 1 inch (25.4 mm) in width, 8 inches (203 mm) in length and  $\frac{1}{16}$  inch (1.6 mm) in thickness, or the equivalent.

2. The location and condition of existing veneer anchor ties shall be verified as follows:
  - 2.1. An approved testing laboratory shall verify the location and spacing of the ties and shall submit a report to the building official for approval as part of the structural analysis.
  - 2.2. The veneer in a selected area shall be removed to expose a representative sample of ties (not less than four) for inspection by the building official.

**A113.8 Nonstructural masonry walls.** Unreinforced masonry walls that carry no design vertical or lateral loads and that are not required by the design to be part of the lateral-force resisting system shall be adequately anchored to new or existing supporting elements. The anchors and elements shall be designed for the out-of-plane forces specified in the building code. The height- or length-to-thickness ratio between such supporting elements for such walls shall not exceed nine.

**A113.9 Truss and beam supports.** Where trusses and beams other than rafters or joists are supported on masonry, independent secondary columns shall be installed to support vertical loads of the roof or floor members.

**Exception:** Secondary supports are not required where  $S_{D1}$  is less than 0.3g.

**A113.10 Adjacent buildings.** Where elements of adjacent buildings do not have a separation of at least 5 inches (127 mm), the allowable height-to-thickness ratios for “all other buildings” per Table A1-B shall be used in the direction of consideration.

### SECTION A114 WALLS OF UNBURNED CLAY, ADOBE OR STONE MASONRY

**A114.1 General.** Walls of unburned clay, adobe or stone masonry construction shall conform to the following:

1. Walls of unburned clay, adobe or stone masonry shall not exceed a height- or length-to-thickness ratio specified in Table A1-G.
2. Adobe may be allowed a maximum value of 9 pounds per square inch (62.1 kPa) for shear unless higher values are justified by test.
3. Mortar for repointing may be of the same soil composition and stabilization as the brick, in lieu of cement-mortar.

TABLE A1-A—ELEMENTS REGULATED BY THIS CHAPTER

BUILDING ELEMENTS	$S_{D1}$			
	$\geq 0.067_g < 0.133_g$	$\geq 0.133_g < 0.20_g$	$\geq 0.20_g < 0.30_g$	$> 0.30_g$
Parapets	X	X	X	X
Walls, anchorage	X	X	X	X
Walls, $h/t$ ratios		X	X	X
Walls, in-plane shear		X	X	X
Diaphragms <sup>a</sup>			X	X
Diaphragms, shear transfer <sup>b</sup>		X	X	X
Diaphragms, demand-capacity ratios <sup>b</sup>			X	X

a. Applies only to buildings designed according to the general procedures of Section A110.

b. Applies only to buildings designed according to the special procedures of Section A111.

TABLE A1-B—ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS

WALL TYPES	$0.13_g \leq S_{D1} < 0.25_g$	$0.25_g \leq S_{D1} < 0.4_g$	$S_{D1} \geq 0.4_g$ BUILDINGS WITH CROSSWALLS <sup>a</sup>	$S_{D1} > 0.4_g$ ALL OTHER BUILDINGS
Walls of one-story buildings	20	16	16 <sup>b,c</sup>	13
First-story wall of multistory building	20	18	16	15
Walls in top story of multistory building	14	14	14 <sup>b,c</sup>	9
All other walls	20	16	16	13

a. Applies to the special procedures of Section A111 only. See Section A111.7 for other restrictions.

b. This value of height-to-thickness ratio may be used only where mortar shear tests establish a tested mortar shear strength,  $v_t$ , of not less than 100 pounds per square inch (690 kPa). This value may also be used where the tested mortar shear strength is not less than 60 pounds per square inch (414 kPa), and where a visual examination of the collar joint indicates not less than 50-percent mortar coverage.

c. Where a visual examination of the collar joint indicates not less than 50-percent mortar coverage, and the tested mortar shear strength,  $v_t$ , is greater than 30 pounds per square inch (207 kPa) but less than 60 pounds per square inch (414 kPa), the allowable height-to-thickness ratio may be determined by linear interpolation between the larger and smaller ratios in direct proportion to the tested mortar shear strength.

TABLE A1-C—HORIZONTAL FORCE FACTOR,  $C_p$ 

CONFIGURATION OF MATERIALS	$C_p$
Roofs with straight or diagonal sheathing and roofing applied directly to the sheathing, or floors with straight tongue-and-groove sheathing.	0.50
Diaphragms with double or multiple layers of boards with edges offset, and blocked plywood systems.	0.75
Diaphragms of metal deck without topping:	
Minimal welding or mechanical attachment.	0.6
Welded or mechanically attached for seismic resistance.	0.68

TABLE A1-D—STRENGTH VALUES FOR EXISTING MATERIALS

EXISTING MATERIALS OR CONFIGURATION OF MATERIALS <sup>a</sup>		STRENGTH VALUES
		x 14.594 for N/m
Horizontal diaphragms	Roofs with straight sheathing and roofing applied directly to the sheathing.	300 lbs. per ft. for seismic shear
	Roofs with diagonal sheathing and roofing applied directly to the sheathing.	750 lbs. per ft. for seismic shear
	Floors with straight tongue-and-groove sheathing.	300 lbs. per ft. for seismic shear
	Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular.	1,500 lbs. per ft. for seismic shear
	Floors with diagonal sheathing and finished wood flooring.	1,800 lbs. per ft. for seismic shear
	Metal deck welded with minimal welding. <sup>c</sup>	1,800 lbs. per ft. for seismic shear
	Metal deck welded for seismic resistance. <sup>d</sup>	3,000 lbs. per ft. for seismic shear
Crosswalls <sup>b</sup>	Plaster on wood or metal lath.	600 lbs. per ft. for seismic shear
	Plaster on gypsum lath.	550 lbs. per ft. for seismic shear
	Gypsum wallboard, unblocked edges.	200 lbs. per ft. for seismic shear
	Gypsum wallboard, blocked edges.	400 lbs. per ft. for seismic shear
Existing footing, wood framing, structural steel, reinforcing steel	Plain concrete footings.	$f'_c = 1,500$ psi (10.34 MPa) unless otherwise shown by tests
	Douglas fir wood.	Same as D.F. No. 1
	Reinforcing steel.	$F_y = 40,000$ psi (124.1 N/mm <sup>2</sup> ) maximum
	Structural steel.	$F_y = 33,000$ psi (137.9 N/mm <sup>2</sup> ) maximum

a. Material must be sound and in good condition.

b. Shear values of these materials may be combined, except the total combined value should not exceed 900 pounds per foot (4380 N/m).

c. Minimum 22-gage steel deck with welds to supports satisfying the standards of the Steel Deck Institute.

d. Minimum 22-gage steel deck with  $\frac{3}{4}\phi$  plug welds at an average spacing not exceeding 8 inches (203 mm) and with sidelap welds appropriate for the deck span.

**TABLE A1-E—STRENGTH VALUES OF NEW MATERIALS USED  
IN CONJUNCTION WITH EXISTING CONSTRUCTION**

NEW MATERIALS OR CONFIGURATION OF MATERIALS		STRENGTH VALUES
Horizontal diaphragms	Plywood sheathing applied directly over existing straight sheathing with ends of plywood sheets bearing on joists or rafters and edges of plywood located on center of individual sheathing boards.	675 lbs. per ft.
Crosswalls	Plywood sheathing applied directly over wood studs; no value should be given to plywood applied over existing plaster or wood sheathing.	1.2 times the value specified in the current building code.
	Drywall or plaster applied directly over wood studs.	The value specified in the current building code.
	Drywall or plaster applied to sheathing over existing wood studs.	50 percent of the value specified in the current building code.
Tension bolts <sup>e</sup>	Bolts extending entirely through unreinforced masonry wall secured with bearing plates on far side of a three-wythe- minimum wall with at least 30 square inches of area. <sup>b,c</sup>	5,400 lbs. per bolt 2,700 lbs. for two-wythe walls
Shear bolts <sup>e</sup>	Bolts embedded a minimum of 8 inches into unreinforced masonry walls; bolts should be centered in 2½-inch-diameter holes with dry-pack or nonshrink grout around the circumference of the bolt.	The value for plain masonry specified for solid masonry in the current building code; no value larger than those given for ¾-inch bolts should be used.
Combined tension and shear bolts	Through-bolts—bolts meeting the requirements for shear and for tension bolts. <sup>b,c</sup>	Tension—same as for tension bolts Shear—same as for shear bolts
	Embedded bolts—bolts extending to the exterior face of the wall with a 2½-inch round plate under the head and drilled at an angle of 22½ degrees to the horizontal; installed as specified for shear bolts. <sup>a,b,c</sup>	Tension—3,600 lbs. per bolt Shear—same as for shear bolts
Infilled walls	Reinforced masonry infilled openings in existing unreinforced masonry walls; provide keys or dowels to match reinforcing.	Same as values specified for unreinforced masonry walls
Reinforced masonry <sup>d</sup>	Masonry piers and walls reinforced per the current building code.	The value specified in the current building code for strength design.
Reinforced concrete <sup>d</sup>	Concrete footings, walls and piers reinforced as specified in the current building code.	The value specified in the current building code for strength design.

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>, 1 pound = 4.4 N.

a. Embedded bolts to be tested as specified in Section A107.4.

b. Bolts to be ½ inch (12.7 mm) minimum in diameter.

c. Drilling for bolts and dowels shall be done with an electric rotary drill; impact tools should not be used for drilling holes or tightening anchors and shear bolt nuts.

d. No load factors or capacity reduction factor shall be used.

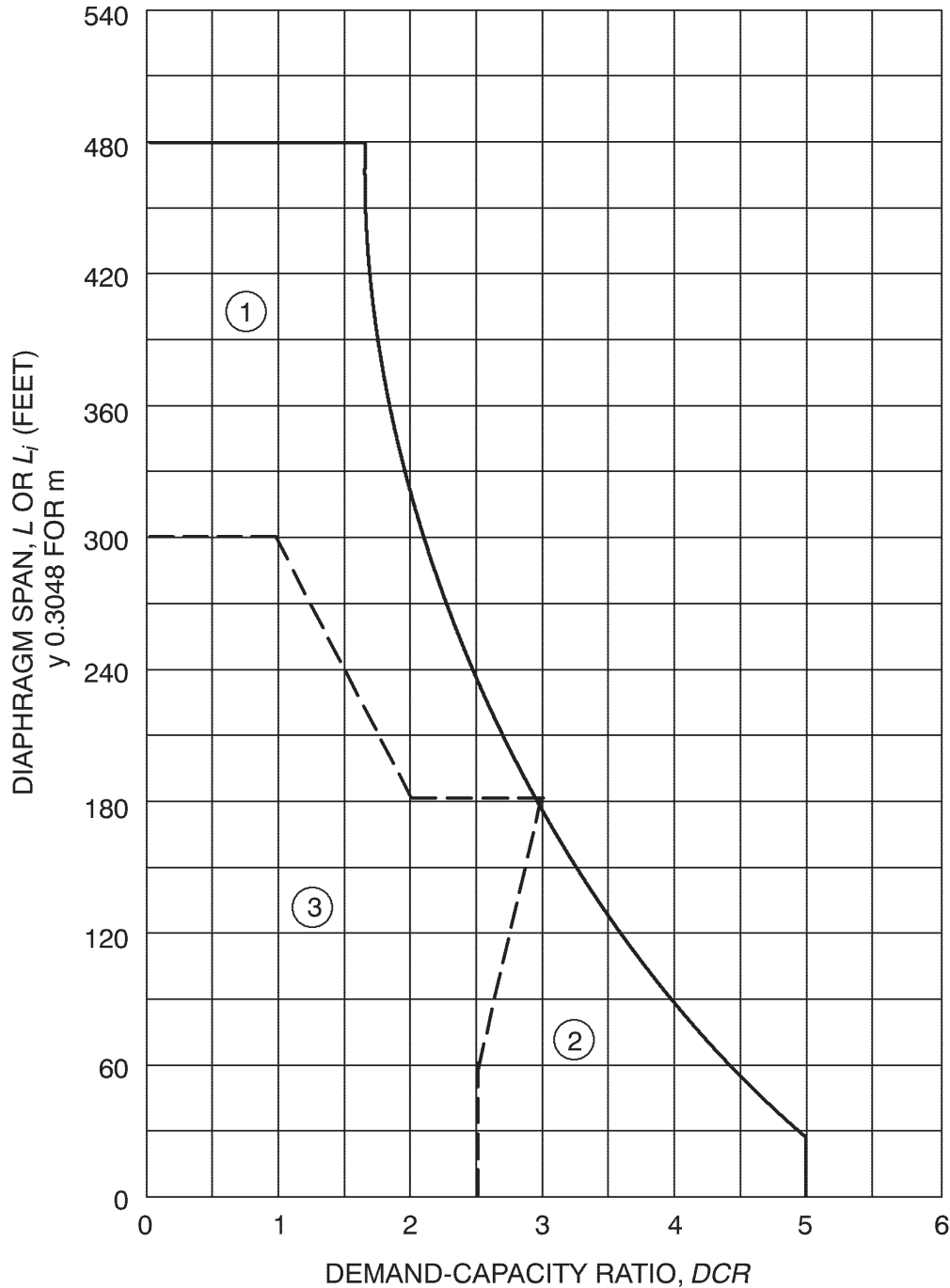
e. Other bolt sizes, values and installation methods may be used, provided a testing program is conducted in accordance with UBC Standard 21-7. The useable value shall be determined by multiplying the calculated allowable value, as determined by UBC Standard 21-7, by 3.0, and the useable value shall be limited to a maximum of 1.5 times the value given in the table. Bolt spacing shall not exceed 6 feet (1829 mm) on center and shall not be less than 12 inches (305 mm) on center.

**TABLE A1-F—MAXIMUM ALLOWABLE HEIGHT-TO-THICKNESS RATIOS FOR PARAPETS**

	$S_{D1}$		
	$0.13_g \leq S_{D1} < 0.25_g$	$0.25_g \leq S_{D1} < 0.4_g$	$S_{D1} \geq 0.4_g$
Maximum allowable height-to-thickness ratios	2.5	2.5	1.5

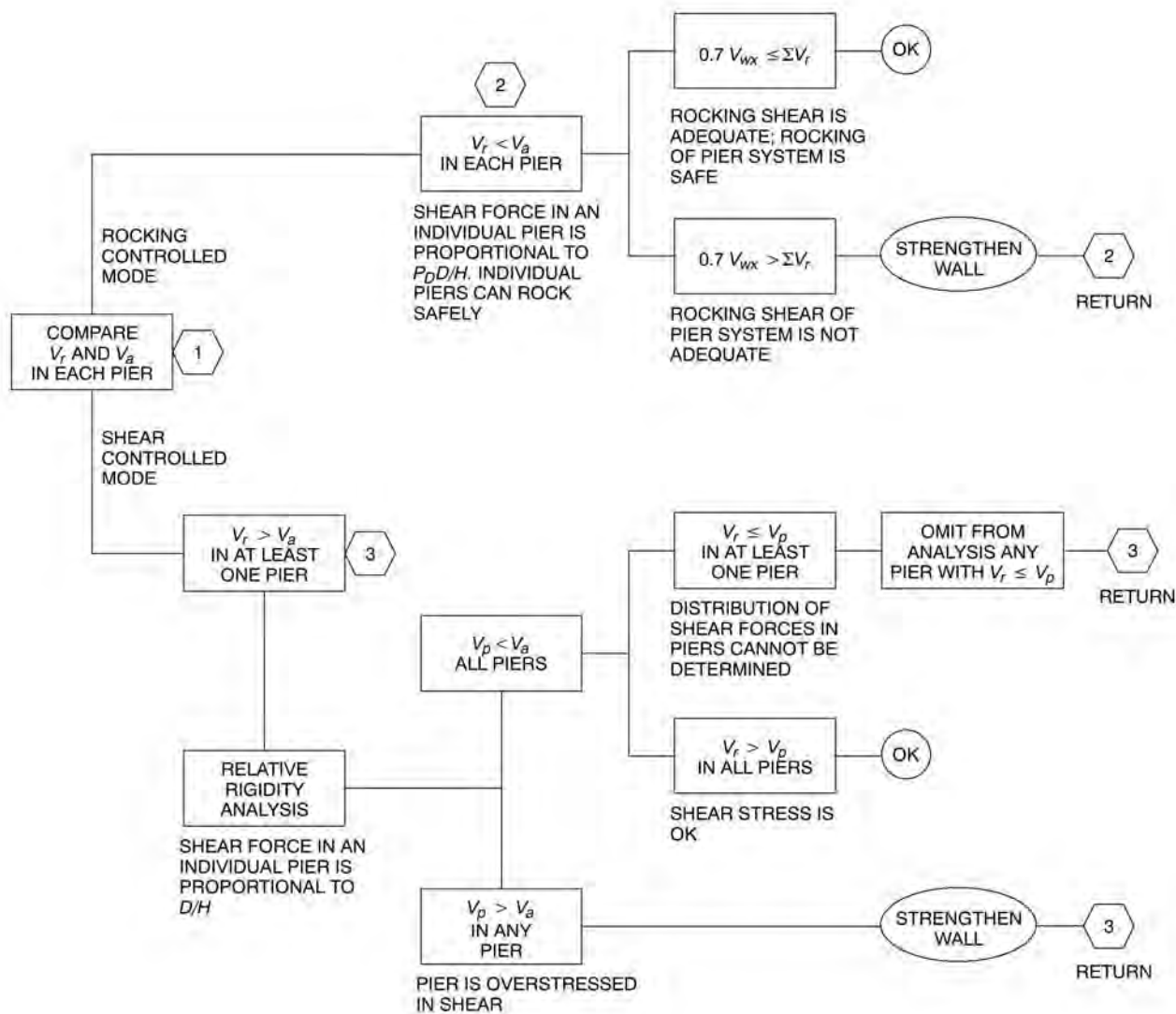
**TABLE A1-G—MAXIMUM HEIGHT-TO-THICKNESS RATIOS FOR ADOBE OR STONE WALLS**

	$S_{D1}$		
	$0.13_g \leq S_{D1} < 0.25_g$	$0.25_g \leq S_{D1} < 0.4_g$	$S_{D1} \geq 0.4_g$
One-story buildings	12	10	8
Two-story buildings			
First story	14	11	9
Second story	12	10	8



1. Region of demand-capacity ratios where crosswalls may be used to increase  $h/t$  ratios.
2. Region of demand-capacity ratios where  $h/t$  ratios of “buildings with crosswalls” may be used, whether or not crosswalls are present.
3. Region of demand-capacity ratios where  $h/t$  ratios of “all other buildings” shall be used, whether or not crosswalls are present.

**FIGURE A1-1**  
**ACCEPTABLE DIAPHRAGM SPAN**



$V_a$  = Allowable shear strength of a pier.

$V_p$  = Shear force assigned to a pier on the basis of a relative shear rigidity analysis.

$V_r$  = Rocking shear capacity of pier.

$V_{wx}$  = Total shear force resisted by the wall.

$\Sigma V_r$  = Rocking shear capacity of all piers in the wall.

FIGURE A1-2  
ANALYSIS OF URM WALL IN-PLANE SHEAR FORCES



## REFERENCED STANDARDS

### UNIFORM BUILDING CODE STANDARD 21-4 HOLLOW AND SOLID LOAD-BEARING CONCRETE MASONRY UNITS

Based on Standard Specification C 90-95 of the ASTM International.  
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ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428

**Note:** See Appendix Chapter 1, Section A106, California Existing Building Code

#### Section 21.401 — Scope

This standard covers solid (units with 75 percent or more net area) and hollow load-bearing concrete masonry units made from portland cement, water and mineral aggregates with or without the inclusion of other materials.

#### Section 21.402 — Classification

**21.402.1 Types.** Two types of concrete masonry units in each of two grades are covered as follows:

**21.402.1.1 Type I, moisture-controlled units.** Units designated as Type I shall conform to all requirements of this standard including the moisture content requirements of Table 21-4-A.

**21.402.1.2 Type II, nonmoisture-controlled units.** Units designated as Type II shall conform to all requirements of this standard except the moisture content requirements of Table 21-4-A.

**21.402.2 Grades.** Concrete masonry units manufactured in accordance with this standard shall conform to two grades as follows:

**21.402.2.1 Grade N.** Units having a weight classification of 85 pcf (1360 kg/m<sup>3</sup>) or greater, for general use such as in exterior walls below and above grade that may or may not be exposed to moisture penetration or the weather and for interior walls and backup.

**21.402.2.2 Grade S.** Units having a weight classification of less than 85 pcf (1360 kg/m<sup>3</sup>), for uses limited to above-grade installation in exterior walls with weather-protective coatings and in walls not exposed to the weather.

#### Section 21.403 — Materials

**21.403.1 Cementitious materials.** Materials shall conform to the following applicable standards:

1. Portland Cement—ASTM C 150 modified as follows:

Limitation on insoluble residue—1.5 percent maximum.  
Limitation on air content of mortar,  
Volume percent—22 percent maximum.  
Limitation on loss on ignition—7 percent maximum.  
Limestone with a minimum 85 percent calcium carbonate (CaCO<sub>3</sub>) content may be added to the cement, pro-

vided the requirements of ASTM C 150 as modified above are met.

2. Blended Cements—ASTM C 595.
3. Hydrated Lime, Type S—UBC Standard 21-13.

**21.403.2 Other constituents and aggregates.** Air-entraining agents, coloring pigments, integral water repellents, finely ground silica, aggregates, and other constituents, shall be previously established as suitable for use in concrete or shall be shown by test or experience to not be detrimental to the durability of the concrete.

#### Section 21.404 — Physical Requirements

At the time of delivery to the work site, the units shall conform to the physical requirements prescribed in Table 21-4-B. The moisture content of Type I concrete masonry units at time of delivery shall conform to the requirements prescribed in Table 21-4-A.

At the time of delivery to the purchaser, the linear shrinkage of Type II units shall not exceed 0.065 percent.

#### Section 21.405 — Minimum Face-shell and Web Thicknesses

Face-shell (FST) and web (WT) thicknesses shall conform to the requirements listed in Table 21-4-C.

#### Section 21.406 — Permissible Variations in Dimensions

**21.406.1 Precision units.** For precision units, no overall dimension (width, height and length) shall differ by more than  $\frac{1}{8}$  inch (3.2 mm) from the specified standard dimensions.

**21.406.2 Particular feature units.** For particular feature units, dimensions shall be in accordance with the following:

1. For molded face units, no overall dimension (width, height and length) shall differ by more than  $\frac{1}{8}$  inch (3.2 mm) from the specified standard dimension. Dimensions of molded features (ribs, scores, hex-shapes, patterns, etc.) shall be within  $\frac{1}{16}$  inch (1.6 mm) of the specified standard dimensions and shall be within  $\frac{1}{16}$  inch (1.6 mm) of the specified placement of the unit.
2. For split-faced units, all non-split overall dimensions (width, height and length) shall differ by no more than  $\frac{1}{8}$



## REFERENCED STANDARDS

inch (3.2 mm) from the specified standard dimensions. On faces that are split, overall dimensions will vary. Local suppliers should be consulted to determine dimensional tolerances achievable.

- For slumped units, no overall height dimension shall differ by more than  $\frac{1}{8}$  inch (3.2 mm) from the specified standard dimension. On faces that are slumped, overall dimensions will vary. Local suppliers should be consulted to determine dimension tolerances achievable.

**Note:** Standard dimensions of units are the manufacturer's designated dimensions. Nominal dimensions of modular size units, except slumped units, are equal to the standard dimensions plus  $\frac{3}{8}$  inch (9.5 mm), the thickness of one standard mortar joint. Slumped units are equal to the standard dimensions plus  $\frac{1}{2}$  inch (13 mm), the thickness of one standard mortar joint. Nominal dimensions of nonmodular size units usually exceed the standard dimensions by  $\frac{1}{8}$  inch to  $\frac{1}{4}$  inch (3.2 mm to 6.4 mm).

### Section 21.407 — Visual Inspection

All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Units may have minor cracks incidental to the usual method of manufacture, or minor chipping resulting from customary methods of handling in shipment and delivery.

Units that are intended to serve as a base for plaster or stucco shall have a sufficiently rough surface to afford a good bond.

Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks or other imperfections when viewed from 20 feet (6100 mm), except that not more than 5 percent of a shipment may have slight cracks or small chips not larger than 1 inch (25.4 mm).

### Section 21.408 — Methods of Sampling and Testing

The purchaser or authorized representative shall be accorded proper facilities to inspect and sample the units at the place of manufacture from the lots ready for delivery.

Sample and test units in accordance with ASTM C 140.

Total linear drying shrinkage shall be based on tests of concrete masonry units made with the same materials, concrete mix design, manufacturing process and curing method, conducted in accordance with ASTM C 426 and not more than 24 months prior to delivery.

### Section 21.409 — Rejection

If the samples tested from a shipment fail to conform to the specified requirements, the manufacturer may sort it, and new specimens shall be selected by the purchaser from the retained lot and tested at the expense of the manufacturer. If the second set of specimens fails to conform to the specified requirements, the entire lot shall be rejected.

**TABLE 21-4-A  
MOISTURE CONTENT REQUIREMENTS FOR TYPE I UNITS**

LINEAR SHRINKAGE, PERCENT	MOISTURE CONTENT, MAX. PERCENT OF TOTAL ABSORPTION (Average of 3 Units)		
	Humidity Conditions at Job site or Point of Use		
	Humid <sup>1</sup>	Intermediate <sup>2</sup>	Arid <sup>3</sup>
0.03 or less	45	40	35
From 0.03 to 0.045	40	35	30
0.045 to 0.065, max.	35	30	25

<sup>1</sup>Average annual relative humidity above 75 percent.

<sup>2</sup>Average annual relative humidity 50 to 75 percent.

<sup>3</sup>Average annual relative humidity less than 50 percent.

**TABLE 21-4-B  
STRENGTH AND ABSORPTION REQUIREMENTS**

COMPRESSIVE STRENGTH, MIN, psi (MPa)		WATER ABSORPTION, MAX, lb./ft. (kg/m) (Average of 3 Units)		
Average Net Area		Weight Classification—Oven-dry Weight of Concrete, lb./ft. (kg/m)		
Average of 3 Units	Individual Unit	Lightweight, Less than 105 (1680)	Medium Weight, 105 to less than 125 (1680–2000)	Normal Weight, 125 (2000) or more
1900 (13.1)	1700 (11.7)	18 (288)	15 (240)	13 (208)

**TABLE 21-4-C**  
**MINIMUM THICKNESS OF FACE-SHELLS AND WEBS**

NOMINAL WIDTH (W) OF UNIT (inches)	FACE-SHELL THICKNESS (FST) MIN., (inches) <sup>1, 4</sup>	WEB THICKNESS (WT)	
		Webs <sup>1</sup> Min., (inches)	Equivalent Web Thickness, Min., in./Lin. Ft. <sup>2</sup>
	× 25.4 for mm		× 83 for mm/lin. m
3 and 4	$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{5}{8}$
6	1	1	$2\frac{1}{4}$
8	$1\frac{1}{4}$	1	$2\frac{1}{4}$
10	$1\frac{3}{8}$	$1\frac{1}{8}$	$2\frac{1}{2}$
	$1\frac{1}{4}$ <sup>3</sup>		
12	$1\frac{1}{2}$	$1\frac{1}{8}$	$2\frac{1}{2}$
	$1\frac{1}{4}$ <sup>3</sup>		

<sup>1</sup>Average of measurements on three units taken at the thinnest point.

<sup>2</sup>Sum of the measured thickness of all webs in the unit, multiplied by 12 (305 when using metric), and divided by the length of the unit. In the case of open-ended units where the open-ended portion is solid grouted, the length of that open-ended portion shall be deducted from the overall length of the unit.

<sup>3</sup>This face-shell thickness (FST) is applicable where allowable design load is reduced in proportion to the reduction in thicknesses shown, except that allowable design load on solid-grouted units shall not be reduced.

<sup>4</sup>For split-faced units, a maximum of 10 percent of a shipment may have face-shell thicknesses less than those shown, but in no case less than  $\frac{3}{4}$  inch (19 mm).

## UNIFORM BUILDING CODE STANDARD 21-6 IN-PLACE MASONRY SHEAR TESTS

See Appendix Chapter 1, Sections A1 06.3.3 and A1 07.2, *Uniform Code for Building Conservation*  
Note: See Appendix Chapter A1, Section A104, *California Existing Building Code*.

### Section 21.601 — Scope

This standard applies when the *Uniform Code for Building Conservation (California Existing Building Code)* requires in-place testing of the quality of masonry mortar.

### Section 21.602 — Preparation of Sample

The bed joints of the outer wythe of the masonry shall be tested in shear by laterally displacing a single brick relative to the adjacent bricks in the same wythe. The head joint opposite the loaded end of the test brick shall be carefully excavated and cleared. The brick adjacent to the loaded end of the test brick shall be carefully removed by sawing or drilling and excavating to provide space for a hydraulic ram and steel loading blocks.

### Section 21.603 — Application of Load and Determination of Results

Steel blocks, the size of the end of the brick, shall be used on each end of the ram to distribute the load to the brick. The blocks shall not contact the mortar joints. The load shall be applied horizontally, in the plane of the wythe, until either a crack can be seen or slip occurs. The strength of the mortar shall be calculated by dividing the load at the first cracking or movement of the test brick by the nominal gross area of the sum of the two bed joints.

## UNIFORM BUILDING CODE STANDARD 21-7 TESTS OF ANCHORS IN UNREINFORCED MASONRY WALLS

See Appendix Chapter 1, Section A1 07.3 and A1 07.4, *Uniform Code for Building Conservation*  
Note: See Appendix Chapter A1, Section A105, A107.3, A107.4 and Table A1-E, *California Existing Building Code*.

### Section 21.701 — Scope

Shear and tension anchors in existing masonry construction shall be tested in accordance with this standard when required by the *Uniform Code for Building Conservation (California Existing Building Code)*.

### Section 21.702 — Direct Tension Testing of Existing Anchors and New Bolts

The test apparatus shall be supported by the masonry wall. The distance between the anchor and the test apparatus support shall not be less than one half the wall thickness for existing anchors and 75 percent of the embedment for new embedded bolts. Existing wall anchors shall be given a preload of 300 pounds (1335 N) prior to establishing a datum for recording elongation. The tension test load reported shall be recorded at  $\frac{1}{8}$  inch (3.2 mm) relative movement of the existing anchor and the adjacent masonry surface. New embedded tension bolts shall be subject to a direct tension load of not less than 2.5 times the design load but not less than 1,500 pounds (6672 N) for five minutes (10 percent deviation).

### Section 21.703 — Torque Testing of New Bolts

Bolts embedded in unreinforced masonry walls shall be tested using a torque-calibrated wrench to the following minimum torques:

- $\frac{1}{2}$ -inch-diameter (13 mm) bolts—40 foot pounds (54.2 N · m)
- $\frac{5}{8}$ -inch-diameter (16 mm) bolts—50 foot pounds (67.8 N · m)
- $\frac{3}{4}$ -inch-diameter (19 mm) bolts—60 foot pounds (81.3 N · m)

### Section 21.704 — Prequalification Test for Bolts and Other Types of Anchors

This section is applicable when it is desired to use tension or shear values for anchors greater than those permitted by Table A-1-E of the *Uniform Code for Building Conservation (California Existing Building Code)*. The direct-tension test procedure set forth in Section 21.702 for existing anchors may be used to determine the allowable tension values for new embedded or through bolts, except that no preload is required. Bolts shall be installed in the same manner and using the same materials as will be used in the actual construction. A minimum of five tests for each bolt size and type shall be performed for each class of masonry in which they are proposed to be used. The allowable tension values for such anchors shall be the lesser of the average ultimate load divided by a factor of safety of 5.0 or the average load of which  $\frac{1}{8}$  inch (3.2 mm) elongation occurs for each size and type of bolt and class of masonry.

Shear bolts may be similarly prequalified. The test procedure shall comply with ASTM E 488-90 or another approved procedure.

The allowable values determined in this manner may exceed those set forth in Table A-1-E of the *Uniform Code for Building Conservation (California Existing Building Code)*.

### Section 21.705 — Reports

Results of all tests shall be reported. The report shall include the test results as related to anchor size and type, orientation of loading, details of the anchor installation and embedment, wall thickness, and joist orientation.

## UNIFORM BUILDING CODE STANDARD 21-8 POINTING OF UNREINFORCED MASONRY WALLS

See Appendix Chapter 1, Section A1 06.3.3.2, *Uniform Code for Building Conservation*  
*Note: See Appendix Chapter A1, Section A103 and A106.3.3.9, California Existing Building Code.*

### Section 21.801 — Scope

Pointing of deteriorated mortar joints when required by the *Uniform Code for Building Conservation (California Existing Building Code)* shall be in accordance with this standard.

### Section 21.802 — Joint Preparation

The old or deteriorated mortar joint shall be cut out, by means of a toothing chisel or nonimpact power tool, to a uniform depth of  $\frac{3}{4}$  inch (19 mm) until sound mortar is reached. Care shall be taken not to damage the brick edges. After cutting is complete, all loose material shall be removed with a brush, air or water stream.

### Section 21.803 — Mortar Preparation

The mortar mix shall be Type N or Type S proportioned as required by the construction specifications. The pointing mortar

shall be pre-hydrated by first thoroughly mixing all ingredients dry and then mixing again, adding only enough water to produce a damp unworkable mix which will retain its form when pressed into a ball. The mortar shall be kept in a damp condition for one and one-half hours; then sufficient water shall be added to bring it to a consistency that is somewhat drier than conventional masonry mortar.

### Section 21.804 — Packing

The joint into which the mortar is to be packed shall be damp but without freestanding water. The mortar shall be tightly packed into the joint in layers not exceeding  $\frac{1}{4}$  inch (6.4 mm) in depth until it is filled; then it shall be tooled to a smooth surface to match the original profile.

## UNIFORM BUILDING CODE STANDARD 21-13 HYDRATED LIME FOR MASONRY PURPOSES

Based on Standard Specification C 207-91 (Reapproved 1992) of the ASTM International.  
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 ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428

See Section 2102.2, Item 3, *Uniform Building Code*  
*Note: See Referenced Standard UBC 21-4*

### Section 21.1301 — Scope

This standard covers four types of hydrated lime. Types N and S are suitable for use in mortar, in the scratch and brown coats of cement plaster, for stucco, and for addition to portland-cement concrete. Types NA and SA are air-entrained hydrated limes that are suitable for use in any of the above uses where the inherent properties of lime and air entrainment are desired. The four types of lime sold under this specification shall be designated as follows:

**Type N**—Normal hydrated lime for masonry purposes.

**Type S**—Special hydrated lime for masonry purposes.

**Type NA**—Normal air-entraining hydrated lime for masonry purposes.

**Type SA**—Special air-entraining hydrated lime for masonry purposes.

**Note:** Type S, special hydrated lime, and Type SA, special air-entraining hydrated lime, are differentiated from Type N, normal hydrated lime, and Type NA, normal air-entraining hydrated lime, principally by their ability to develop high, early plasticity and higher water retentivity and by a limitation on their unhydrated oxide content.

### Section 21.1302 — Definition

**HYDRATED LIME.** The hydrated lime covered by Type N or S in this standard shall contain no additives for the purpose of entraining air. The air content of cement-lime mortars made with Type N or S shall not exceed 7 percent. Types NA and SA shall contain an air-entraining additive as specified by Section 21.1305. The air content of cement-lime mortars made with Type NA or SA shall have a minimum of 7 percent and a maximum of 14 percent.

### Section 21.1303 — Additions

Types NA and SA hydrated lime covered by this standard shall contain additives for the purpose of entraining air.

### Section 21.1304 — Manufacturer's Statement

Where required, the nature, amount and identity of the air-entraining agent used and of any processing addition that may have been used shall be provided, as well as test data showing compliance of such air-entraining addition.

## REFERENCED STANDARDS

### Section 21.1305 — Chemical Requirements Composition

Hydrated lime for masonry purposes shall conform to the requirements as to chemical composition set forth in Table 21-13-A.

### Section 21.1306 — Residue, Popping and Pitting

The four types of hydrated lime for masonry purposes shall conform to one of the following requirements:

1. The residue retained on a No. 30 (600  $\mu$ m) sieve shall not be more than 0.5 percent, or
2. If the residue retained on a No. 30 (600  $\mu$ m) sieve is over 0.5 percent, the lime shall show no pops and pits when tested.

### Section 21.1307 — Plasticity

The putty made from Type S, special hydrate, or Type SA, special air-entraining hydrate, shall have a plasticity figure of not less than 200 within 30 minutes after mixing with water, when tested.

### Section 21.1308 — Water Retention

Hydrated lime mortar made with Type N, normal hydrated lime, or Type NA, normal air-entraining hydrated lime, after suction for 60 seconds, shall have a water-retention value of not less than 75 percent when tested in a standard mortar made from the dry hydrate or from putty made from the hydrate which has been soaked for a period of 16 to 24 hours.

Hydrated lime mortar made with Type S, special hydrated lime, or Type SA, special air-entraining hydrated lime, after suction for 60 seconds, shall have a water-retention value of not less than 85 percent when tested in a standard mortar made from the dry hydrate.

### Section 21.1309 — Special Marking

When Type NA or SA air-entraining hydrated lime is delivered in packages, the type under this standard and the words "air-entraining" shall be plainly indicated thereon or, in case of bulk shipments, so indicated on shipping notices.

### Section 21.1310 — Quality Control

Every 90 days, each lime producer shall retain an approved agency to obtain a random sample from a local point of supply in the market area served by the producer.

The agency shall test the lime for compliance with the physical requirements of Sections 21.1306, 21.1307 and 21.1308.

Upon request of the building official, the producer shall furnish (at no cost) test results to the building official, architect, structural engineer, general contractor and masonry contractor.

### ASTM 653/A & 653M-08 [HCD]

Standard specifications for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process.

TABLE 21-13-A—CHEMICAL REQUIREMENTS

	HYDRATE TYPES			
	N	NA	S	SA
Calcium and magnesium oxides (nonvolatile basis), min. percent	95	95	95	95
Carbon dioxide (as-received basis), max. percent				
If sample is taken at place of manufacture	5	5	5	5
If sample is taken at any other place	7	7	7	7
Unhydrated oxides (as-received basis), max. percent	—	—	8	8

## CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE CHAPTER A3

### PRESCRIPTIVE PROVISIONS FOR SEISMIC STRENGTHENING OF CRIPPLE WALLS AND SILL PLATE ANCHORAGE OF LIGHT, WOOD-FRAME RESIDENTIAL BUILDINGS

Adopting agency	BSC	SFM	HCD			DSA			OSHDP				CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			1	2	1-AC	AC	SS	SS/CC	1	2	3	4								
Adopt entire chapter																				
Adopt entire chapter as amended (amended sections listed below)			X	X																
Adopt only those sections that are listed below																				
Chapter/Section																				
A302			X	X																
Figure A3-2			X	X																
Figure A3-3			X	X																
Figure A3-4A			X	X																
Figure A3-8A			X	X																
Figure A3-8B			X	X																
Figure A3-9			X	X																
Figure A3-10			X	X																
A304.5			X	X																
A304.6			X	X																
Table A3-A			X	X																
Table A3-B			X	X																

*The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*





## CHAPTER A3

# PRESCRIPTIVE PROVISIONS FOR SEISMIC STRENGTHENING OF CRIPPLE WALLS AND SILL PLATE ANCHORAGE OF LIGHT, WOOD-FRAME RESIDENTIAL BUILDINGS

### SECTION A301 GENERAL

**[B] A301.1 Purpose.** The provisions of this chapter are intended to promote public safety and welfare by reducing the risk of earthquake-induced damage to existing wood-frame residential buildings. The requirements contained in this chapter are prescriptive minimum standards intended to improve the seismic performance of residential buildings; however, they will not necessarily prevent earthquake damage.

This chapter sets standards for strengthening that may be approved by the code official without requiring plans or calculations prepared by a registered design professional. The provisions of this chapter are not intended to prevent the use of any material or method of construction not prescribed herein. The code official may require that construction documents for strengthening using alternative materials or methods be prepared by a registered design professional.

**[B] A301.2 Scope.** The provisions of this chapter apply to residential buildings of light-frame wood construction containing one or more of the structural weaknesses specified in Section A303.

**Exception:** The provisions of this chapter do not apply to the buildings, or elements thereof, listed below. These buildings or elements require analysis by a registered design professional in accordance with Section A301.3 to determine appropriate strengthening:

1. Group R-1, R-2 or R-4 occupancies with more than four dwelling units.
2. Buildings with a lateral force-resisting system using poles or columns embedded in the ground.
3. Cripple walls that exceed 4 feet (1219 mm) in height.
4. Buildings exceeding three stories in height and any three-story building with cripple wall studs exceeding 14 inches (356 mm) in height.
5. Buildings where the code official determines that conditions exist that are beyond the scope of the prescriptive requirements of this chapter.
6. Buildings or portions thereof constructed on concrete slabs on grade.

**[B] A301.3 Alternative design procedures.** The details and prescriptive provisions herein are not intended to be the only acceptable strengthening methods permitted. Alternative details and methods may be used where designed by a registered design professional and approved by the code official. Approval of alternatives shall be based on a demonstration that the method or material used is at least equivalent in terms of strength, deflection and capacity to that provided by the prescriptive methods and materials.

Where analysis by a registered design professional is required, such analysis shall be in accordance with all requirements of the building code, except that the seismic forces may be taken as 75 percent of those specified in the building code.

### SECTION A302 DEFINITIONS

For the purpose of this chapter, in addition to the applicable definitions in the building code, certain additional terms are defined as follows:

**[B] ADHESIVE ANCHOR.** An assembly consisting of a threaded rod, washer, nut, and chemical adhesive approved by the code official for installation in existing concrete or masonry.

**CODE OFFICIAL.** “Code Official” shall have the same meaning as Enforcing Agency.

**[B] COMPOSITE PANEL.** A wood structural panel product composed of a combination of wood veneer and wood-based material, and bonded with waterproof adhesive.

**[B] CRIPPLE WALL.** A wood-frame stud wall extending from the top of the foundation to the underside of the lowest floor framing.

**ENFORCING AGENCY.** The designated department or agency as specified by statute or regulation.

**[B] EXPANSION ANCHOR.** An approved post-installed anchor, inserted into a pre-drilled hole in existing concrete or masonry, that transfers loads to or from the concrete or masonry by direct bearing or friction or both.

**[B] ORIENTED STRAND BOARD (OSB).** A mat-formed wood structural panel product composed of thin rectangular wood strands or wafers arranged in oriented layers and bonded with waterproof adhesive.

**[B] PERIMETER FOUNDATION.** A foundation system that is located under the exterior walls of a building.

**[B] PLYWOOD.** A wood structural panel product composed of sheets of wood veneer bonded together with the grain of adjacent layers oriented at right angles to one another.

**[B] SNUG-TIGHT.** As tight as an individual can torque a nut on a bolt by hand, using a wrench with a 10-inch-long (254 mm) handle, and the point at which the full surface of the plate washer is contacting the wood member and slightly indenting the wood surface.

**[B] WAFERBOARD.** A mat-formed wood structural panel product composed of thin rectangular wood wafers arranged in random layers and bonded with waterproof adhesive.



**[B] WOOD STRUCTURAL PANEL.** A structural panel product composed primarily of wood and meeting the requirements of United States Voluntary Product Standard PS 1 and United States Voluntary Product Standard PS 2. Wood structural panels include all-veneer plywood, composite panels containing a combination of veneer and wood-based material, and mat-formed panels such as oriented strand board and waferboard.

### SECTION A303 STRUCTURAL WEAKNESSES

**[B] A303.1 General.** For the purpose of this chapter, structural weaknesses shall be as specified below.

1. Sill plates or floor framing that are supported directly on the ground without a foundation system that conforms to the building code.
2. A perimeter foundation system that is constructed only of wood posts supported on isolated pad footings.
3. Perimeter foundation systems that are not continuous.

#### Exceptions:

1. Existing single-story exterior walls not exceeding 10 feet (3048 mm) in length, forming an extension of floor area beyond the line of an existing continuous perimeter foundation.
2. Porches, storage rooms and similar spaces not containing fuel-burning appliances.
4. A perimeter foundation system that is constructed of unreinforced masonry or stone.
5. Sill plates that are not connected to the foundation or that are connected with less than what is required by the building code.

**Exception:** Where approved by the code official, connections of a sill plate to the foundation made with other than sill bolts may be accepted if the capacity of the connection is equivalent to that required by the building code.

6. Cripple walls that are not braced in accordance with the requirements of Section A304.4 and Table A3-A, or cripple walls not braced with diagonal sheathing or wood structural panels in accordance with the building code.

### SECTION A304 STRENGTHENING REQUIREMENTS

#### A304.1 General.

**[B] A304.1.1 Scope.** The structural weaknesses noted in Section A303 shall be strengthened in accordance with the requirements of this section. Strengthening work may include both new construction and alteration of existing construction. Except as provided herein, all strengthening work and materials shall comply with the applicable provisions of the building code.

**A304.1.2 Condition of existing wood materials.** All existing wood materials that will be a part of the strengthening

work (sills, studs, sheathing, etc.) shall be in a sound condition and free from defects that substantially reduce the capacity of the member. Any wood material found to contain fungus infection shall be removed and replaced with new material. Any wood material found to be infested with insects or to have been infested with insects shall be strengthened or replaced with new materials to provide a net dimension of sound wood at least equal to its undamaged original dimension.

#### **[B] A304.1.3 Floor joists not parallel to foundations.**

Floor joists framed perpendicular or at an angle to perimeter foundations shall be restrained either by an existing nominal 2-inch-wide (51 mm) continuous rim joist or by a nominal 2-inch-wide (51 mm) full-depth block between alternate joists in one- and two-story buildings, and between each joist in three-story buildings. Existing blocking for multi-story buildings must occur at each joist space above a braced cripple wall panel.

Existing connections at the top and bottom edges of an existing rim joist or blocking need not be verified in one-story buildings. In multistory buildings, the existing top edge connection need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum existing bottom edge connection shall consist of 8d toenails spaced 6 inches (152 mm) apart for a continuous rim joist, or three 8d toenails per block. When this minimum bottom edge-connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A3-8A or A3-8C shall be provided.

Where an existing continuous rim joist or the minimum existing blocking does not occur, new  $\frac{3}{4}$ -inch (19 mm) or  $\frac{23}{32}$ -inch (18 mm) wood structural panel blocking installed tightly between floor joists and nailed as shown in Figure A3-9 shall be provided at the inside face of the cripple wall. In lieu of wood structural panel blocking, tight fitting, full-depth 2-inch (51 mm) blocking may be used. New blocking may be omitted where it will interfere with vents or plumbing that penetrates the wall.

**[B] A304.1.4 Floor joists parallel to foundations.** Where existing floor joists are parallel to the perimeter foundations, the end joist shall be located over the foundation and, except for required ventilation openings, shall be continuous and in continuous contact with the foundation sill plate or the top plate of the cripple wall. Existing connections at the top and bottom edges of the end joist need not be verified in one-story buildings. In multistory buildings, the existing top edge connection of the end joist need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum bottom edge connection shall be 8d toenails spaced 6 inches (152 mm) apart. If this minimum bottom edge connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A3-8B, A3-8C or A3-9 shall be provided.

#### A304.2 Foundations.

**[B] A304.2.1 New perimeter foundations.** New perimeter foundations shall be provided for structures with the struc-

tural weaknesses noted in Items 1 and 2 of Section A303. Soil investigations or geotechnical studies are not required for this work unless the building is located in a special study zone as designated by the code official or other authority having jurisdiction.

**[B] A304.2.2 Evaluation of existing foundations.** Partial perimeter foundations or unreinforced masonry foundations shall be evaluated by a registered design professional for the force levels specified in Section A301.3. Test reports or other substantiating data to determine existing foundation material strengths shall be submitted to the code official. Where approved by the code official, these existing foundation systems may be strengthened in accordance with the recommendations included with the evaluation in lieu of being replaced.

**Exception:** In lieu of testing existing foundations to determine material strengths, and where approved by the code official, a new nonperimeter foundation system designed for the forces specified in Section A301.3 may be used to resist lateral forces from perimeter walls. A registered design professional shall confirm the ability of the existing diaphragm to transfer seismic forces to the new nonperimeter foundations.

**[B] A304.2.3 Details for new perimeter foundations.** All new perimeter foundations shall be continuous and constructed according to either Figure A3-1 or A3-2. All new construction materials shall comply with the requirements of building code. Where approved by the code official, the existing clearance between existing floor joists or girders and existing grade below the floor need not comply with the building code.

**Exception:** Where designed by a registered design professional and approved by the code official, partial perimeter foundations may be used in lieu of a continuous perimeter foundation.

**[B] A304.2.4 New concrete foundations.** New concrete foundations shall have a minimum compressive strength of 2,500 pounds per square inch (17.24 MPa) at 28 days.

**[B] A304.2.5 New hollow-unit masonry foundations.** New hollow-unit masonry foundations shall be solidly grouted. The grout shall have minimum compressive strength of 2,000 pounds per square inch (13.79 MPa). Mortar shall be Type M or S.

**[B] A304.2.6 New sill plates.** Where new sill plates are used in conjunction with new foundations, they shall be minimum 2x nominal thickness and shall be preservative-treated wood or naturally durable wood permitted by the building code for similar applications, and shall be marked or branded by an approved agency. Nails in contact with preservative-treated wood shall be hot-dip galvanized or other material permitted by the building code for similar applications. Metal framing anchors in contact with preservative treated wood shall be galvanized in accordance with ASTM A 653 with a G185 coating.

### **[B] A304.3 Foundation sill plate anchorage.**

**[B] A304.3.1 Existing perimeter foundations.** Where the building has an existing continuous perimeter foundation,

all perimeter wall sill plates shall be anchored to the foundation with adhesive anchors or expansion anchors in accordance with Table A3-A.

Anchors shall be installed in accordance with Figure A3-3, with the plate washer installed between the nut and the sill plate. The nut shall be tightened to a snug-tight condition after curing is complete for adhesive anchors and after expansion wedge engagement for expansion anchors. All anchors shall be installed in accordance with manufacturer's recommendations. Where existing conditions prevent anchor installations through the sill plate, this connection may be made in accordance with Figure A3-4A, A3-4B, or A3-4C. The spacing of these alternate connections shall comply with the maximum spacing requirements of Table A3-A. Expansion anchors shall not be used where the installation causes surface cracking of the foundation wall at the locations of the bolt.

**[B] A304.3.2 Placement of anchors.** Anchors shall be placed within 12 inches (305 mm), but not less than 9 inches (229 mm), from the ends of sill plates and shall be placed in the center of the stud space closest to the required spacing. New sill plates may be installed in pieces where necessary because of existing conditions. For lengths of sill plates greater than 12 feet (3658 mm), anchors or bolts shall be spaced along the sill plate as specified in Table A3-A. For other lengths of sill plate, anchor placement shall be in accordance with Table A3-B.

**Exception:** Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of an anchor, the anchor shall be placed as close to the obstruction as possible, but not less than 9 inches (229 mm) from the end of the plate. Center-to-center spacing of the anchors shall be reduced as necessary to provide the minimum total number of anchors required based on the full length of the wall. Center-to-center spacing shall not be less than 12 inches (305 mm).

**[B] A304.3.3 New perimeter foundations.** Sill plates for new perimeter foundations shall be anchored in accordance with Table A3-A and as shown in Figure A3-1 or A3-2.

### **A304.4 Cripple wall bracing.**

**[B] A304.4.1 General.** Exterior cripple walls not exceeding 4 feet (1219 mm) in height shall be permitted to be specified by the prescriptive bracing method in Section A304.4. Cripple walls over 4 feet (1219 mm) in height require analysis by a registered design professional in accordance with Section A301.3.

**[B] A304.4.1.1 Sheathing installation requirements.** Wood structural panel sheathing shall not be less than  $\frac{15}{32}$ -inch (12 mm) thick and shall be installed in accordance with Figure A3-5 or A3-6. All individual pieces of wood structural panels shall be nailed with 8d common nails spaced 4 inches (102 mm) on center at all edges and 12 inches (305 mm) on center at each intermediate support with not less than two nails for each stud. Nails shall be driven so that their heads are flush with the surface of the sheathing and shall penetrate the supporting member

a minimum of 1½ inches (38 mm). When a nail fractures the surface, it shall be left in place and not counted as part of the required nailing. A new 8d nail shall be located within 2 inches (51 mm) of the discounted nail and be hand-driven flush with the sheathing surface. Where the installation involves horizontal joints, those joints shall occur over nominal 2-inch by 4-inch (51 mm by 102 mm) blocking installed with the nominal 4-inch (102 mm) dimension against the face of the plywood.

Vertical joints at adjoining pieces of wood structural panels shall be centered on studs such that there is a minimum ⅛ inch (3.2 mm) between the panels, and such that the nails are placed a minimum of ½ inch (12.7 mm) from the edges of the existing stud. Where such edge distances cannot be maintained because of the width of the existing stud, a new stud shall be added adjacent to the existing studs and connected in accordance with Figure A3-7.

**[B] A304.4.2 Distribution and amount of bracing.** See Table A3-A and Figure A3-10 for the distribution and amount of bracing required for each wall line. Each braced panel length must be at least two times the height of the cripple stud. Where the minimum amount of bracing prescribed in Table A3-A cannot be installed along any walls, the bracing must be designed in accordance with Section A301.3.

**Exception:** Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of cripple wall bracing, the bracing shall then be placed as close to the obstruction as possible. The total amount of bracing required shall not be reduced because of obstructions.

**[B] A304.4.3 Stud space ventilation.** When bracing materials are installed on the interior face of studs forming an enclosed space between the new bracing and the existing exterior finish, each braced stud space must be ventilated. Adequate ventilation and access for future inspection shall be provided by drilling one 2-inch to 3-inch-diameter (51 mm to 76 mm) round hole through the sheathing, nearly centered between each stud at the top and bottom of the cripple wall. Such holes should be spaced a minimum of 1 inch (25 mm) clear from the sill or top plates. In stud spaces containing sill bolts, the hole shall be located on the center line of the sill bolt but not closer than 1 inch (25 mm) clear from the nailing edge of the sheathing. When existing blocking occurs within the stud space, additional ventilation holes shall be placed above and below the blocking, or the existing

block shall be removed and a new nominal 2-inch by 4-inch (51 mm by 102 mm) block shall be installed with the nominal 4-inch (102 mm) dimension against the face of the plywood. For stud heights less than 18 inches (457 mm), only one ventilation hole need be provided.

**[B] A304.4.4 Existing underfloor ventilation.** Existing underfloor ventilation shall not be reduced without providing equivalent new ventilation as close to the existing ventilation as possible. Braced panels may include underfloor ventilation openings when the height of the opening, measured from the top of the foundation wall to the top of the opening, does not exceed 25 percent of the height of the cripple stud wall; however, the length of the panel shall be increased a distance equal to the length of the opening or one stud space minimum. Where an opening exceeds 25 percent of the cripple wall height, braced panels shall not be located where the opening occurs. See Figure A3-7.

**Exception:** For homes with a post and pier foundation system where a new continuous perimeter foundation system is being installed, new ventilation shall be provided in accordance with the building code.

**[B] A304.5 Inspections.** All work shall be subject to inspection by the code official including, but not limited to:

1. Placement and installation of new adhesive or expansion anchors installed in existing foundations. Special inspection *may be* required for adhesive anchors installed in existing foundations regulated by the prescriptive provisions of this chapter.
2. Installation and nailing of new cripple wall bracing.
3. Any work may be subject to special inspection when required by the code official in accordance with the building code.

**[B] A304.5.1 Nails.** All nails specified in this chapter shall be common wire nails of the following diameters and lengths: 8d nails shall be 0.131 inch by 2½ inches. 10d nails shall be 0.148 inch by 3 inches. 12d nails shall be 0.148 inch by 3¼ inches. 16d nails shall be 0.162 inch by 3½ inches. Nails used to attach metal framing connectors directly to wood members shall be as specified by the connector manufacturer in an approved report.

**A304.6 Phasing of the strengthening work.** *When approved by the Enforcing Agency, the strengthening work contained in this chapter may be completed in phases.*

**[B] TABLE A3-A  
SILL PLATE ANCHORAGE AND CRIPPLE WALL BRACING**

NUMBER OF STORIES ABOVE CRIPPLE WALLS	MINIMUM SILL PLATE CONNECTION AND MAXIMUM SPACING <sup>a,b</sup>	AMOUNT OF BRACING FOR EACH WALL LINE <sup>c,d,e</sup>	
		A Combination of Exterior Walls Finished with Portland Cement Plaster and Roofing Using Clay Tile or Concrete Tile Weighing More than 6 psf (287 N/m <sup>2</sup> )	All Other Conditions
One story	$\frac{1}{2}$ inch (12.7 mm) spaced 6 feet, 0 inch (1829 mm) center-to-center with washer plate	Each end and not less than 50 percent of the wall length	Each end and not less than 40 percent of the wall length
Two stories	$\frac{1}{2}$ inch (12.7 mm) spaced 4 feet, 0 inch (1219 mm) center-to-center with washer plate; or $\frac{5}{8}$ inch (15.9 mm) spaced 6 feet, 0 inch (1829 mm) center-to-center with washer plate	Each end and not less than 70 percent of the wall length	Each end and not less than 50 percent of the wall length
Three stories	$\frac{5}{8}$ inch (15.9 mm) spaced 4 feet, 0 inch (1219 mm) center-to-center with washer plate	100 percent of the wall length <sup>f</sup>	Each end and not less than 80 percent of the wall length <sup>f</sup>

- a. Sill plate anchors shall be *adhesive* anchors or expansion *anchors* in accordance with Section A304.3.1.  
b. All washer plates shall be 3 inches by 3 inches by .229 inch (76 mm by 76 mm by 5.8 mm) minimum.  
c. See Figure A3-10 for braced panel layout.  
d. Braced panels at ends of walls shall be located as near to the end as possible.  
e. All panels along a wall shall be nearly equal in length and shall be nearly equal in spacing along the length of the wall.  
f. The minimum required underfloor ventilation openings are permitted in accordance with Section A304.4.4.

**[B] TABLE A3-B  
SILL PLATE ANCHORAGE FOR VARIOUS LENGTHS OF SILL PLATE<sup>a,b</sup>**

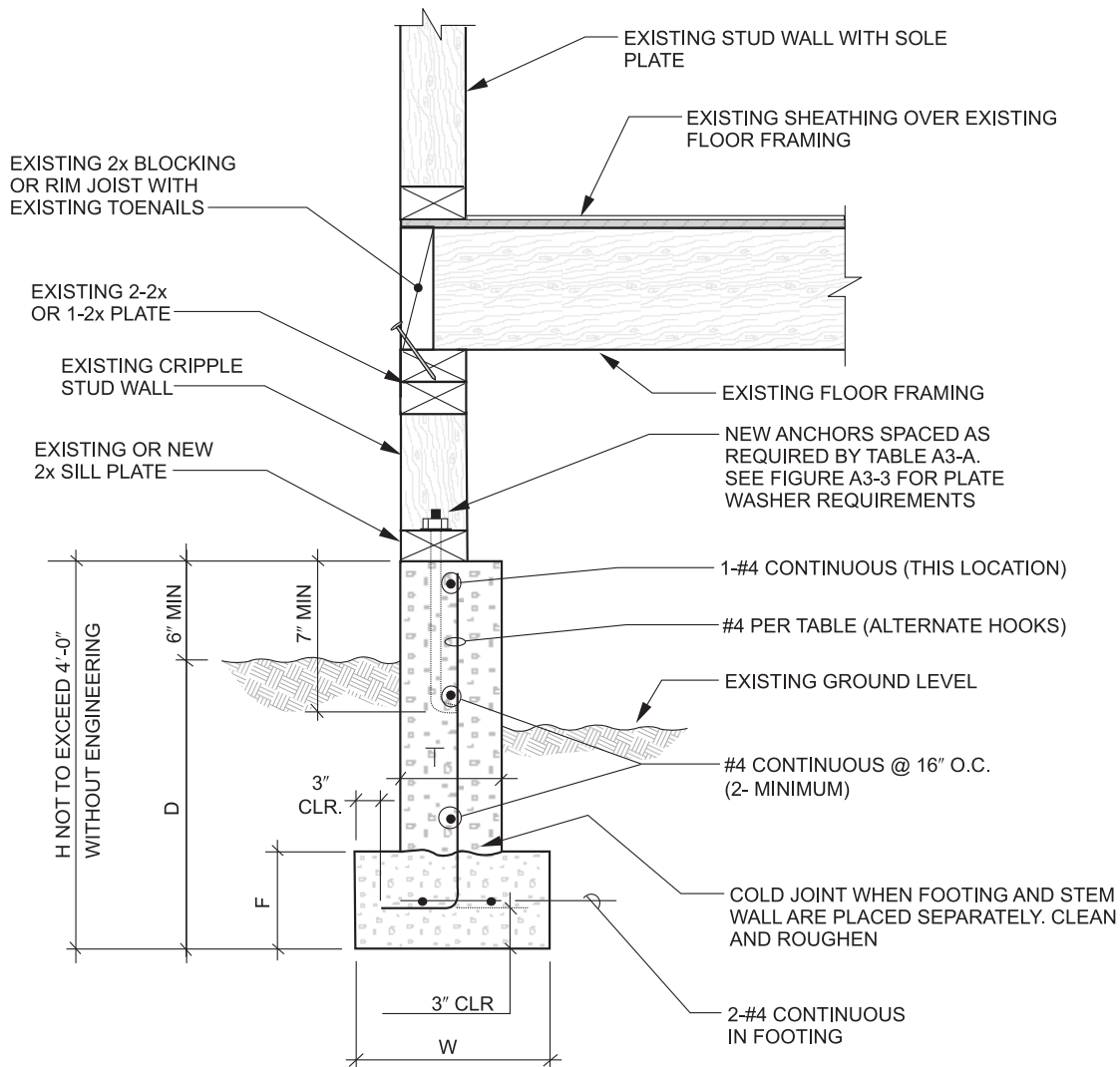
NUMBER OF STORIES	LENGTHS OF SILL PLATE		
	Less than 12 feet (3658 mm) to 6 feet (1829 mm)	Less than 6 feet (1829 mm) to 30 inches (762 mm)	Less than 30 inches footnote (762 mm) <sup>c</sup>
One story	Three connections	Two connections	One connection
Two stories	Four connections for $\frac{1}{2}$ -inch (12.7 mm) anchors or bolts or Three connections for $\frac{5}{8}$ -inch (15.9 mm) anchors or bolts	Two connections	One connection
Three stories	Four connections	Two connections	One connection

- a. Connections shall be either *adhesive* anchors or expansion *anchors*.  
b. See Section A304.3.2 for minimum end distances.  
c. Connections shall be placed as near to the center of the length of plate as possible.

NUMBER OF STORIES	MINIMUM FOUNDATION DIMENSIONS					MINIMUM FOUNDATION REINFORCING	
	W	F	D <sup>a, b, c</sup>	T	H	VERTICAL REINFORCING	
						Single-pour wall and footing	Footing poured separate from wall
1	12 inches (305 mm)	6 inches (152 mm)	12 inches (305 mm)	6 inches (152 mm)	≤ 24 inches (610 mm)	#4 @ 48 inches (1219 mm) on center	#4 @ 32 inches (813 mm) on center
2	15 inches (381 mm)	7 inches (178 mm)	18 inches (457 mm)	8 inches (203 mm)	≥ 36 inches (914 mm)	#4 @ 48 inches (1219 mm) on center	#4 @ 32 inches (813 mm) on center
3	18 inches (457 mm)	8 inches (203 mm)	24 inches (610 mm)	10 inches (254 mm)	≥ 36 inches (914 mm)	#4 @ 48 inches (1219 mm) on center	#4 @ 18 inches (457 mm) on center

- a. Where frost conditions occur, the minimum depth shall extend below the frost line.  
b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.  
c. When expansive soil is encountered, the foundation depth and reinforcement shall be as directed by the *enforcing agency*.

||



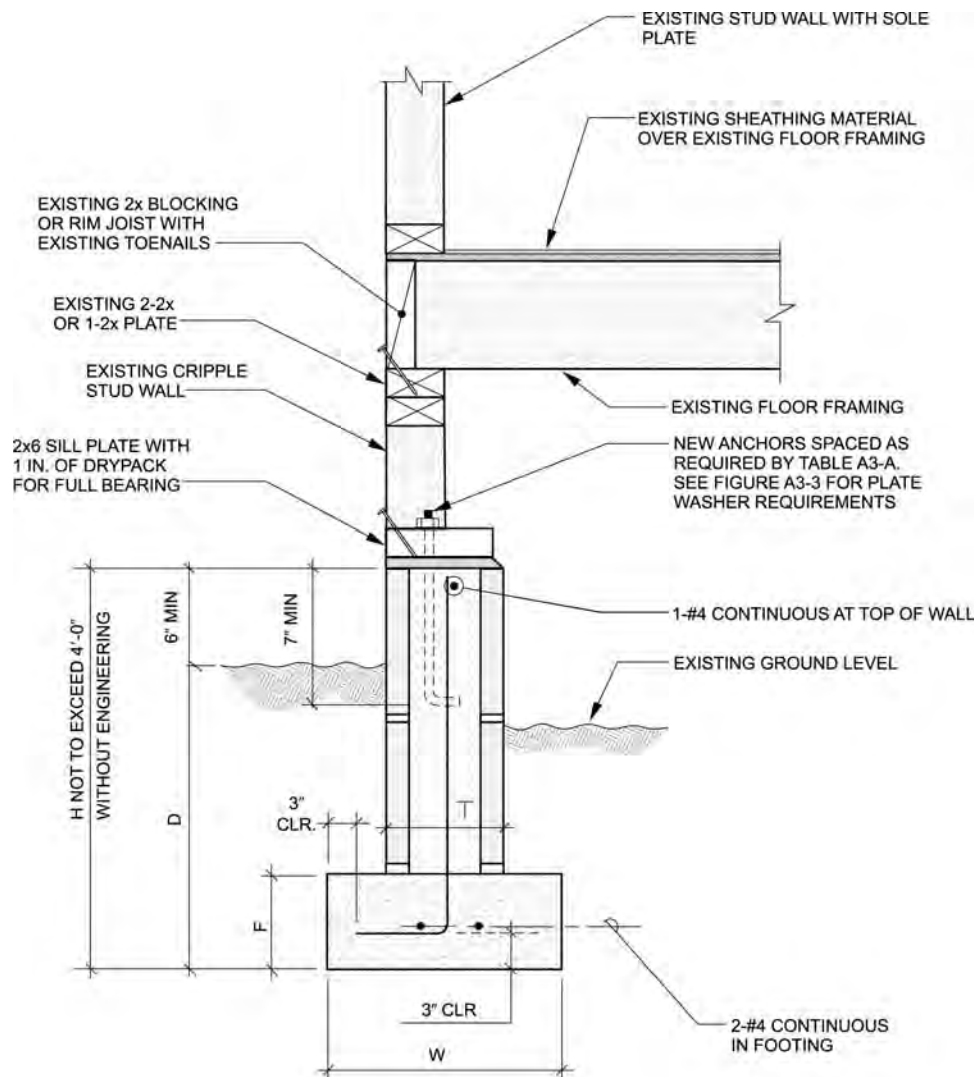
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[B] FIGURE A3-1  
NEW REINFORCED CONCRETE FOUNDATION SYSTEM



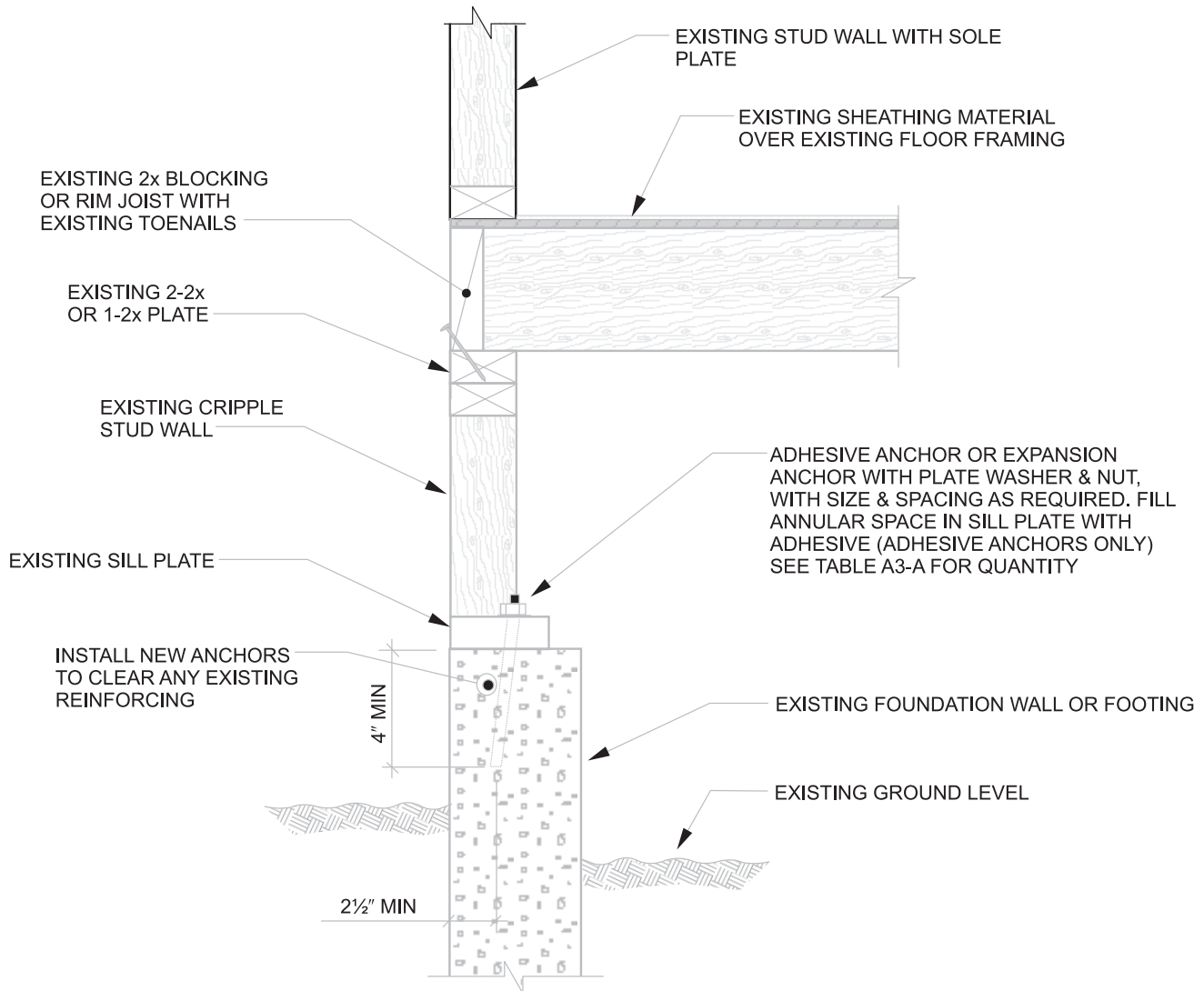
MINIMUM FOUNDATION DIMENSIONS					MINIMUM FOUNDATION REINFORCING		
NUMBER OF STORIES	<i>W</i>	<i>F</i>	<i>D</i> <sup>a, b, c</sup>	<i>T</i>	<i>H</i>	VERTICAL REINFORCING	HORIZONTAL REINFORCING
1	12 inches (305 mm)	6 inches (152 mm)	12 inches (305 mm)	6 inches (152 mm)	≤ 24 inches (610 mm)	#4 @ 24 inches (610 mm) on center	#4 continuous at top of stem wall
2	15 inches (381 mm)	7 inches (178 mm)	18 inches (457 mm)	8 inches (203 mm)	≥ 24 inches (610 mm)	#4 @ 24 inches (610 mm) on center	#4 @ 16 inches (406 mm) on center
3	18 inches (457 mm)	8 inches (203 mm)	24 inches (610 mm)	10 inches (254 mm)	≥ 36 inches (914 mm)	#4 @ 24 inches (610 mm) on center	#4 @ 16 inches (406 mm) on center

- a. Where frost conditions occur, the minimum depth shall extend below the frost line.  
b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.  
c. When expansive soil is encountered, the foundation depth and reinforcement shall be as directed by the *enforcing agency*.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[B] FIGURE A3-2  
NEW HOLLOW-UNIT MASONRY FOUNDATION

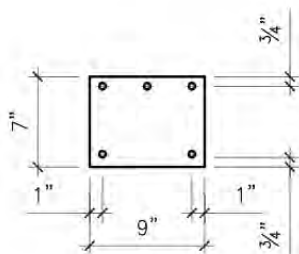
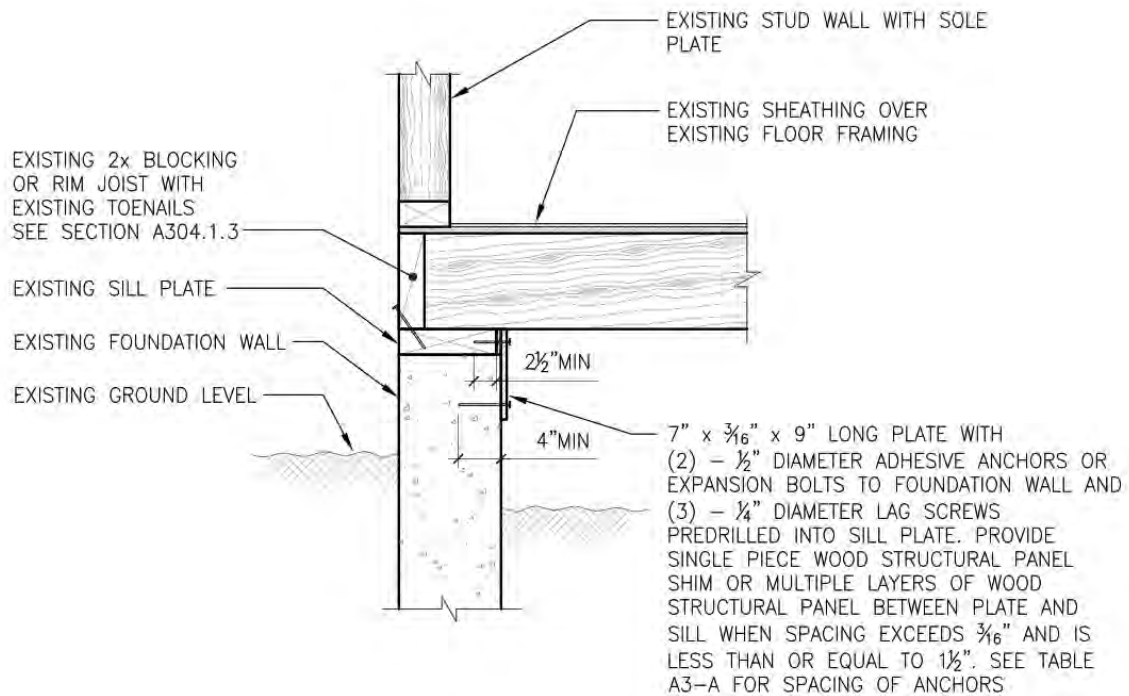


For SI: 1 inch = 25.4 mm.

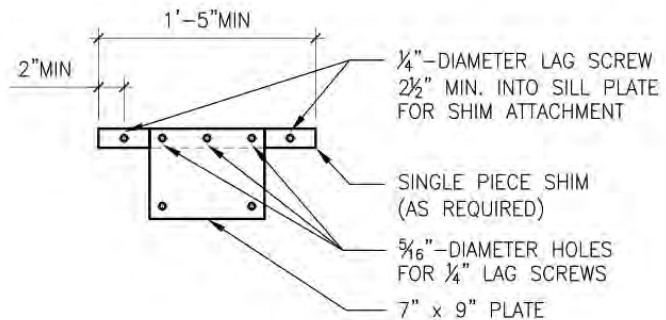
**NOTES:**

1. Plate washers shall comply with the following:  
 $\frac{1}{2}$  in. anchor or bolt—3 × 3 × 0.229 in. (76 mm × 76 mm × 5.8 mm)  
 $\frac{5}{8}$  in. anchor or bolt—3 × 3 × 0.229 in. (76 mm × 76 mm × 5.8 mm)
2. See Figure A3-5 or A3-6 for cripple wall bracing.

**[B] FIGURE A3-3  
SILL PLATE BOLTING TO EXISTING FOUNDATION**



HOLE DIAMETER SHALL NOT EXCEED CONNECTOR DIAMETER BY MORE THAN 1/16"



CONNECTION WHEN SHIM SPACE EXCEEDS ¾" INCH WIDTH UP TO 1½"

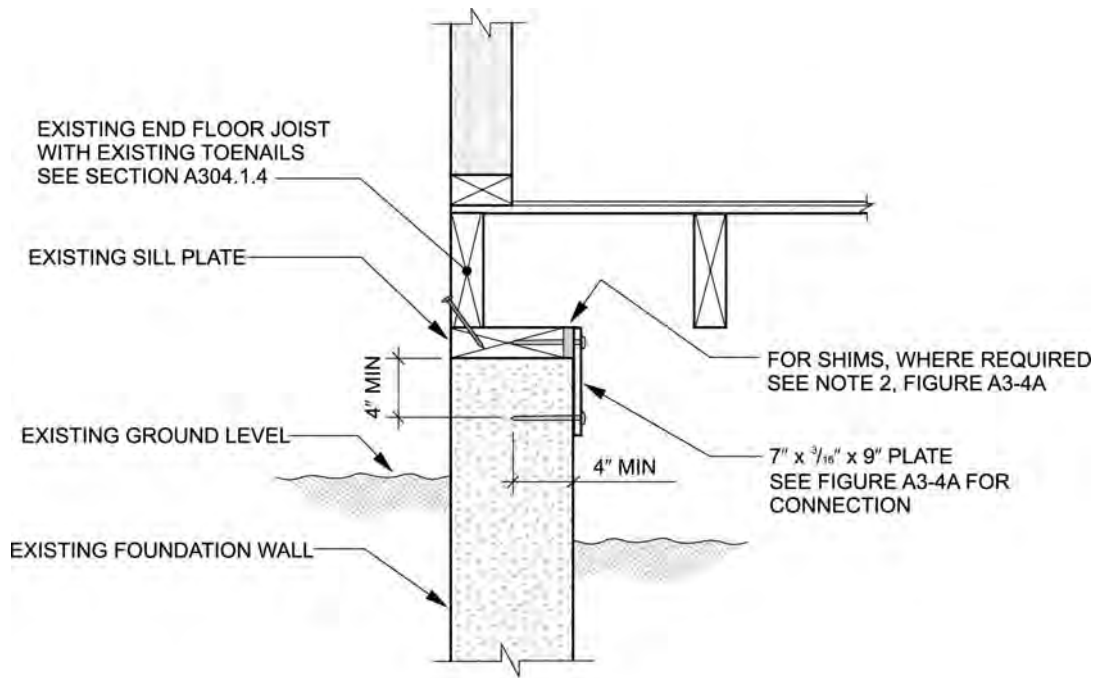
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**NOTES:**

1. If shim space exceeds 2½ in., alternate details will be required.
2. Where required, single piece shim shall be *naturally durable* or preservative-treated wood. If preservative-treated wood is used, it shall be isolated from the foundation system with a moisture barrier.

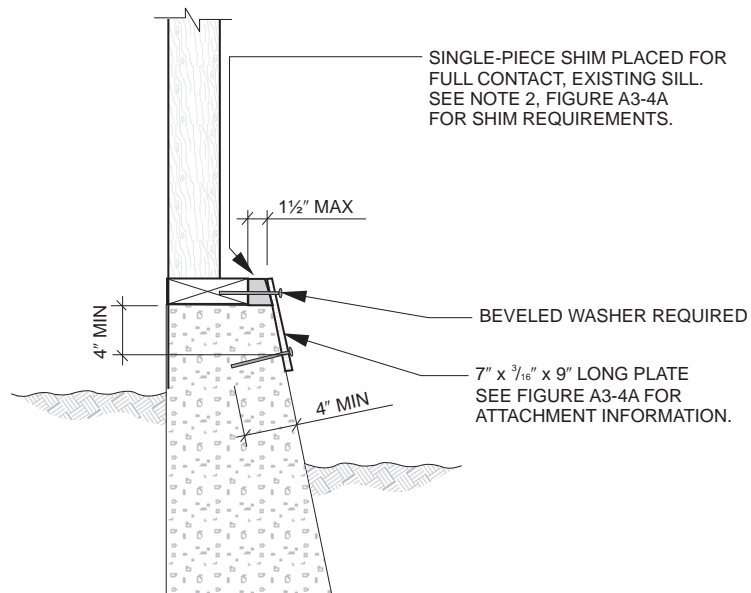
**[B] FIGURE A3-4A**  
**SILL PLATE BOLTING IN EXISTING FOUNDATION—ALTERNATE**





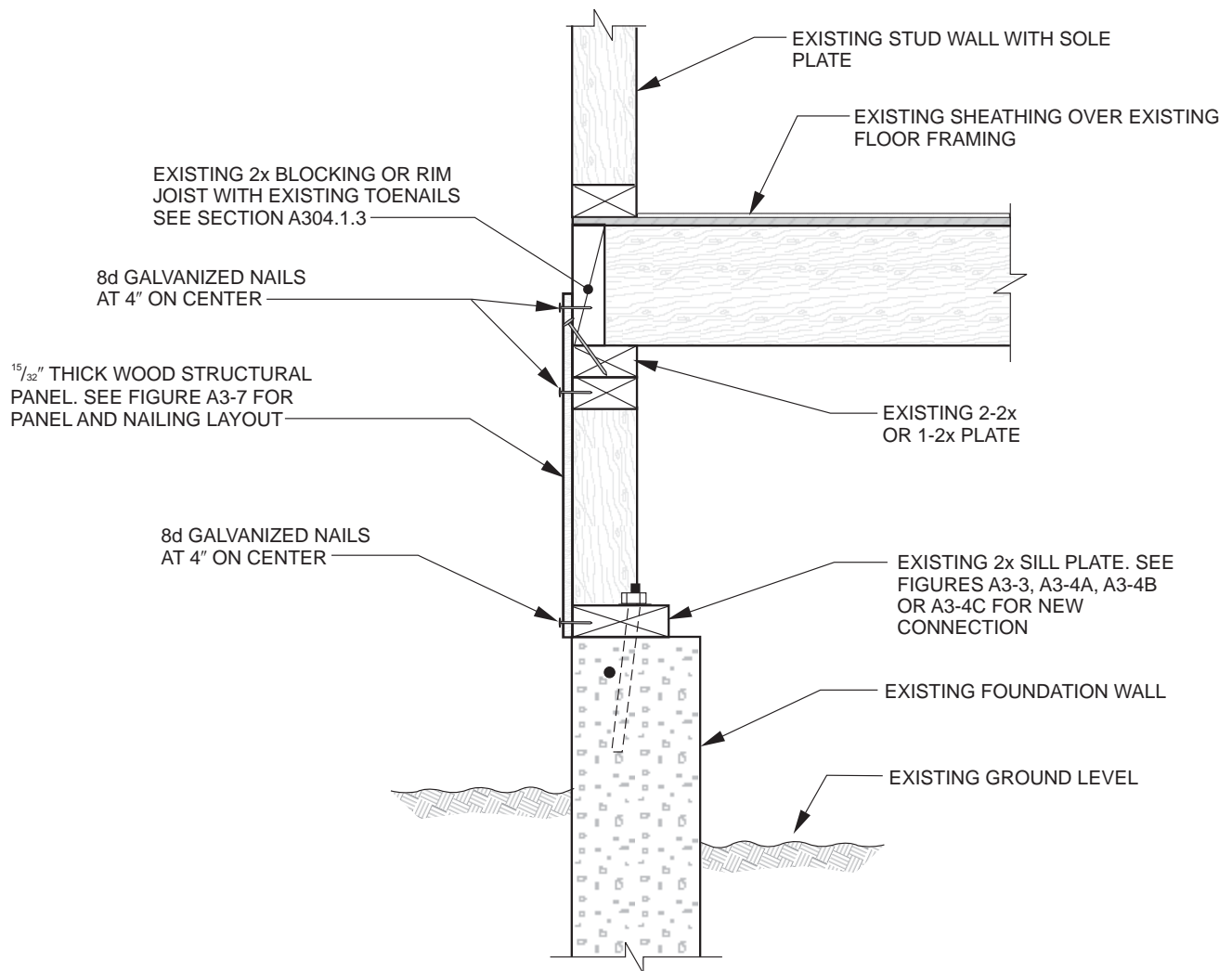
For SI: 1 inch = 25.4 mm.

**[B] FIGURE A3-4B**  
**SILL PLATE BOLTING TO EXISTING FOUNDATION WITHOUT CRIPPLE WALL**  
**AND FRAMING PARALLEL TO THE FOUNDATION WALL**



For SI: 1 inch = 25.4 mm.

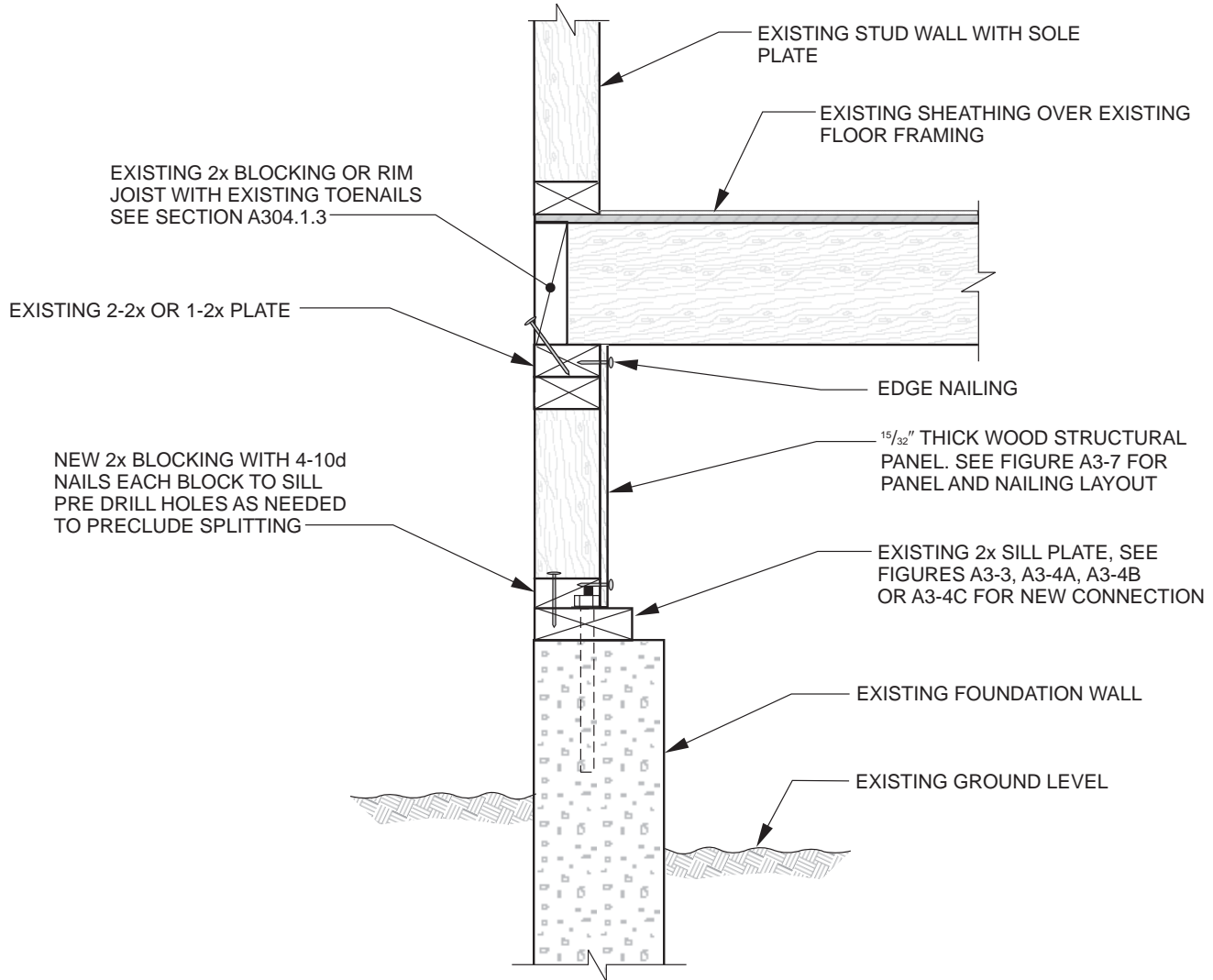
**[B] FIGURE A3-4C**  
**SILL PLATE BOLTING IN EXISTING FOUNDATION—ALTERNATE**



For SI: 1 inch = 25.4 mm.

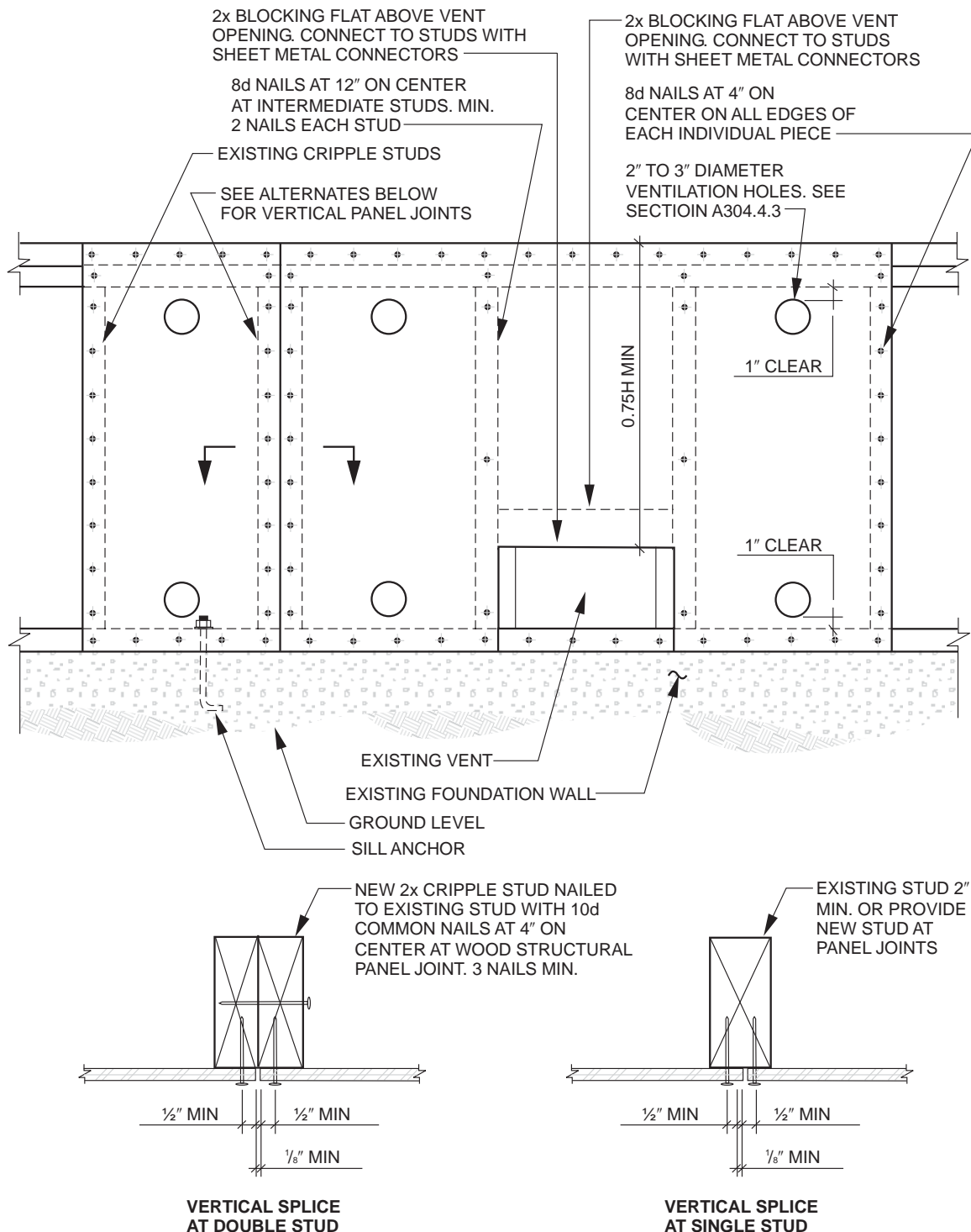
**NOTE:** See Figure A3-3 for sill plate anchoring.

**[B] FIGURE A3-5**  
**CRIPPLE WALL BRACING WITH WOOD STRUCTURAL PANEL**  
**ON EXTERIOR FACE OF CRIPPLE STUDS**



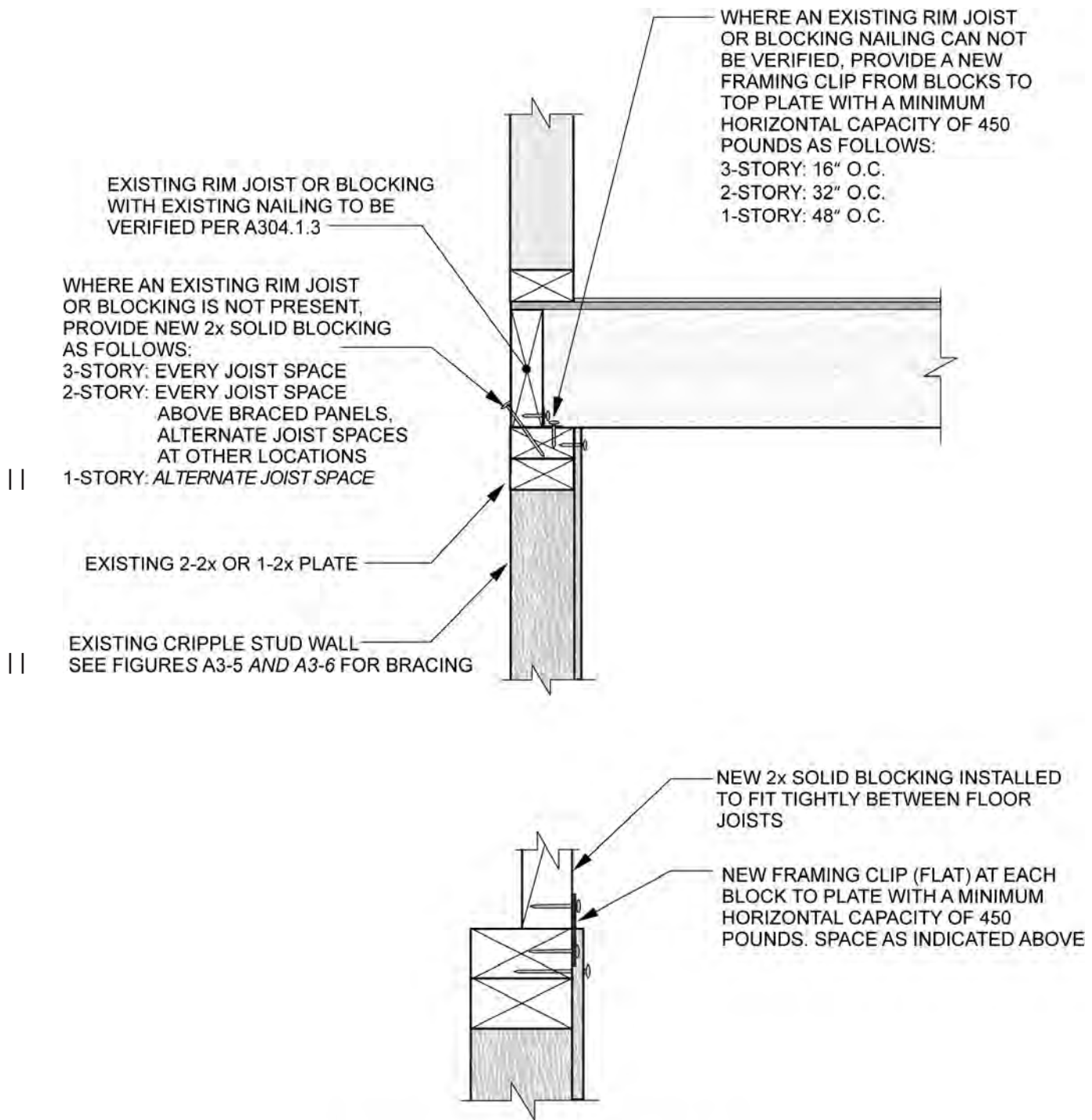
For SI: 1 inch = 25.4 mm.

[B] FIGURE A3-6  
CRIPPLE WALL BRACING WITH WOOD STRUCTURAL PANEL  
ON INTERIOR FACE OF CRIPPLE STUDS



For SI: 1 inch = 25.4 mm.

[B] FIGURE A3-7  
PARTIAL CRIPPLE STUD WALL ELEVATION

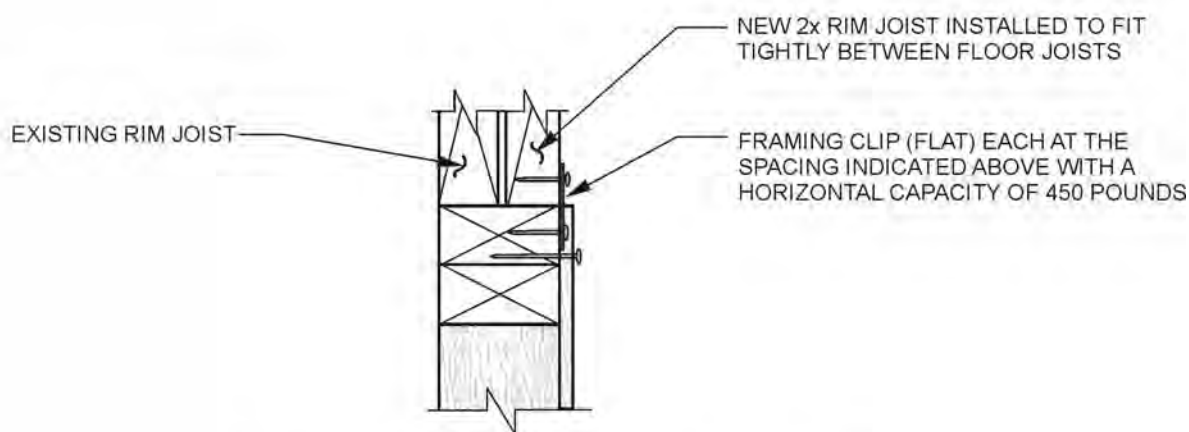
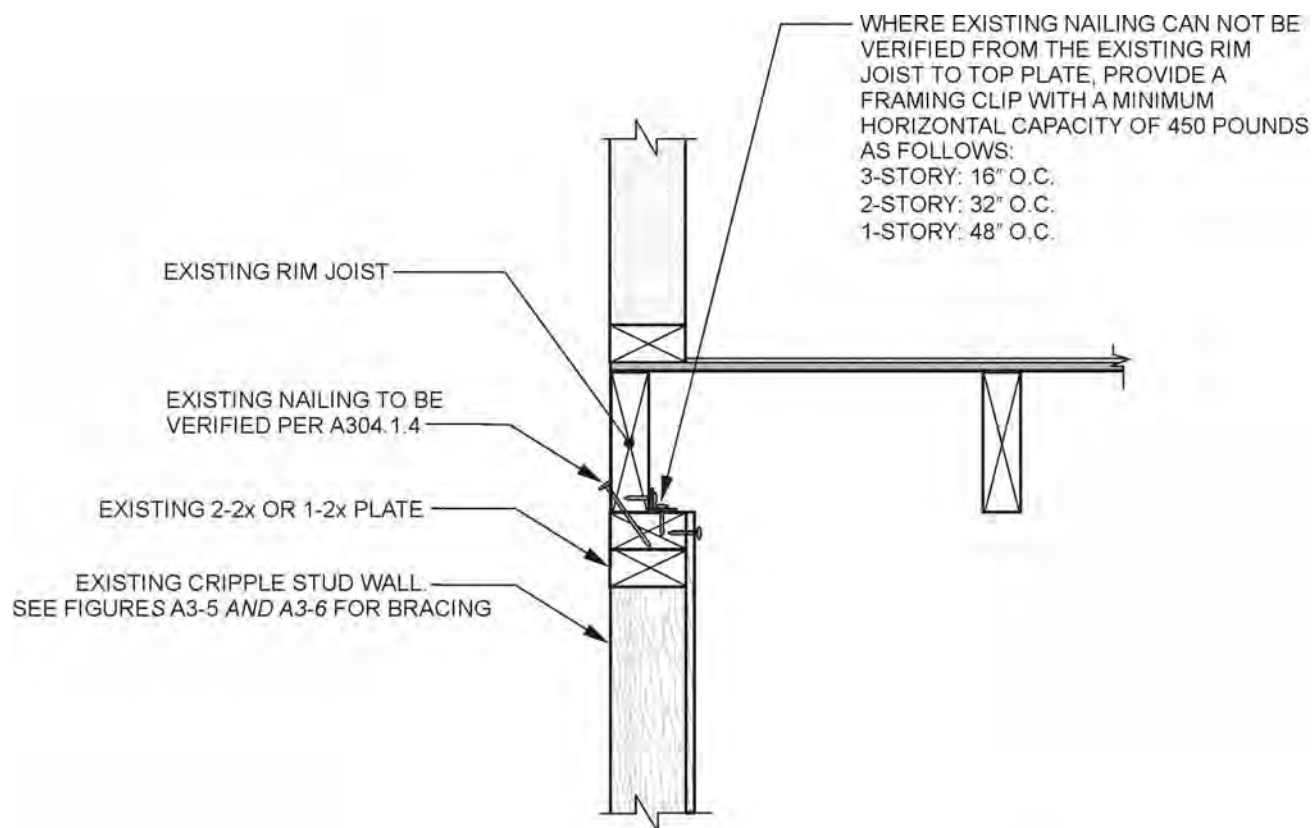


**ALTERNATE DETAIL FOR FLUSH CONDITION**

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

**NOTE:** See manufacturing instructions for nail sizes associated with metal framing clips.

**[B] FIGURE A3-8A  
 TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS NOT PARALLEL TO FOUNDATIONS)**

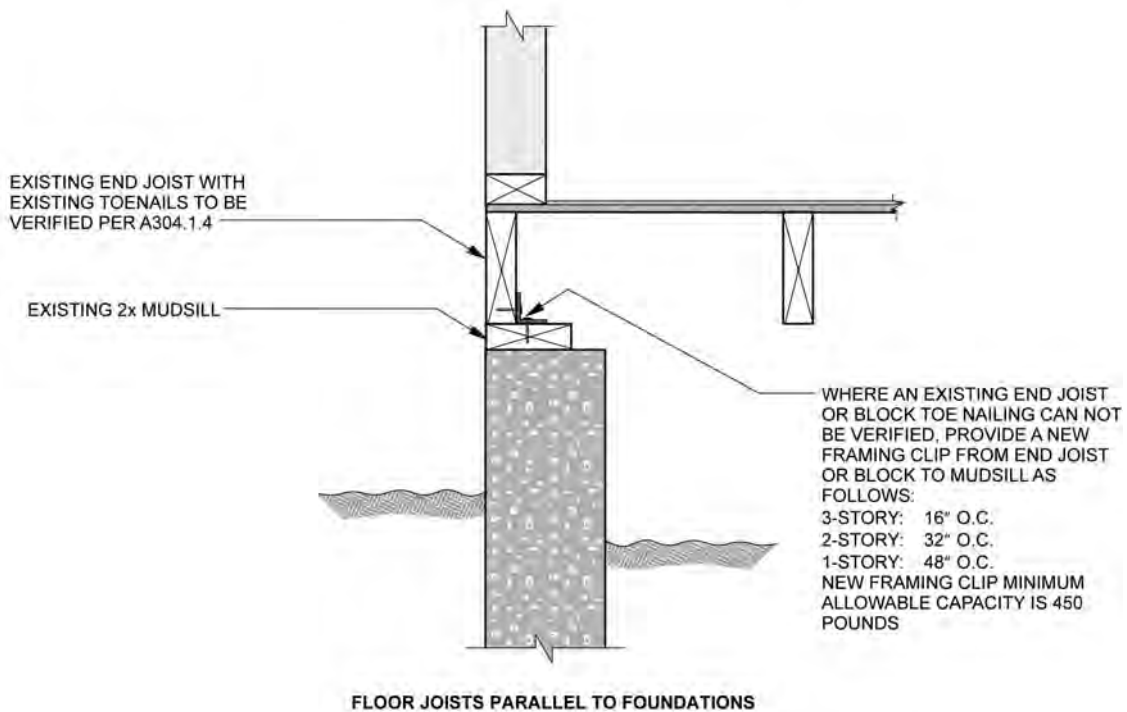
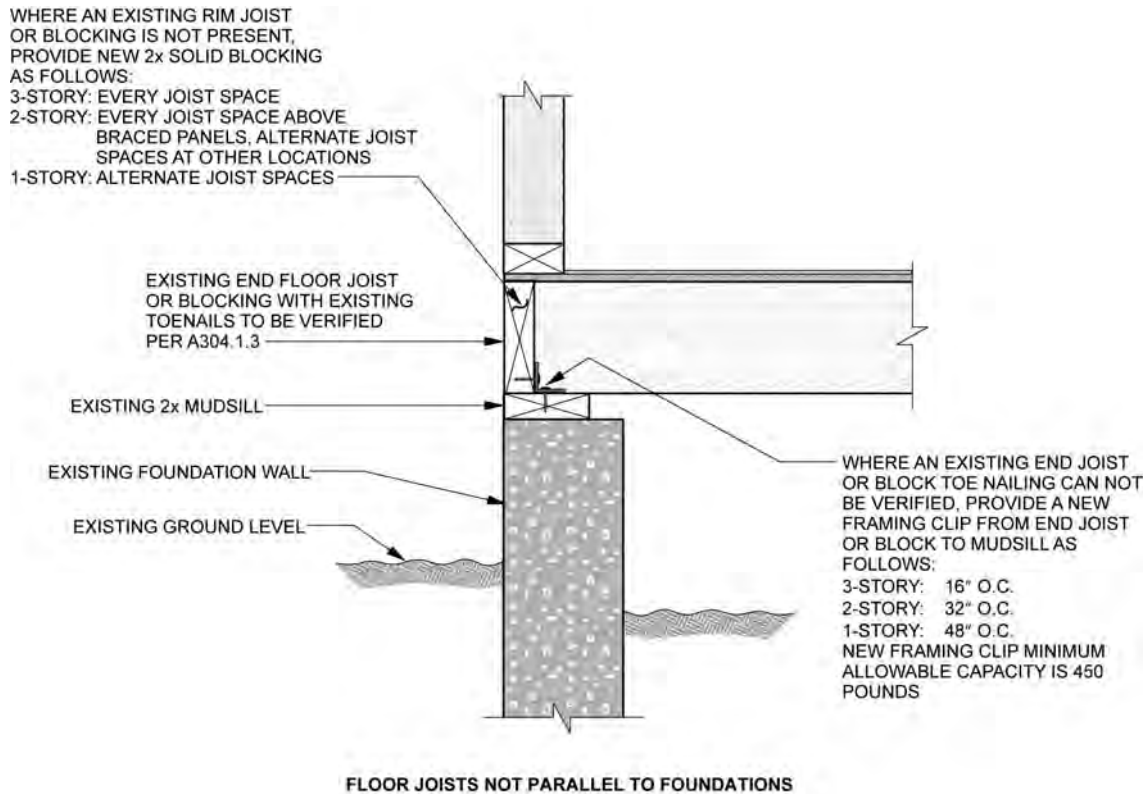


ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

**NOTE:** See manufacturing instructions for nail sizes associated with metal framing clips.

[B] FIGURE A3-8B  
TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS PARALLEL TO FOUNDATIONS)



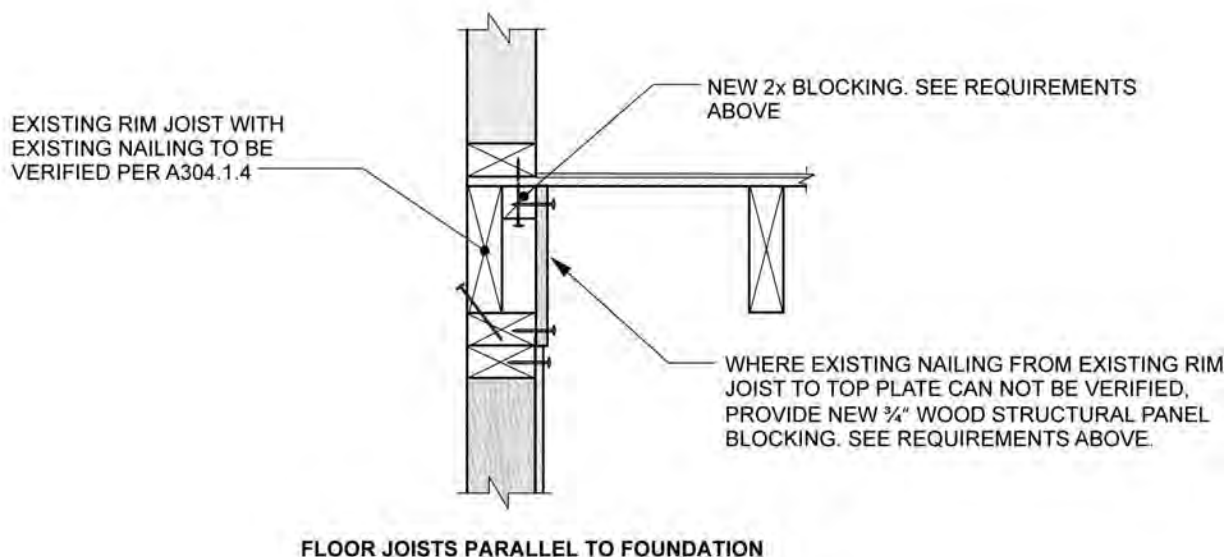
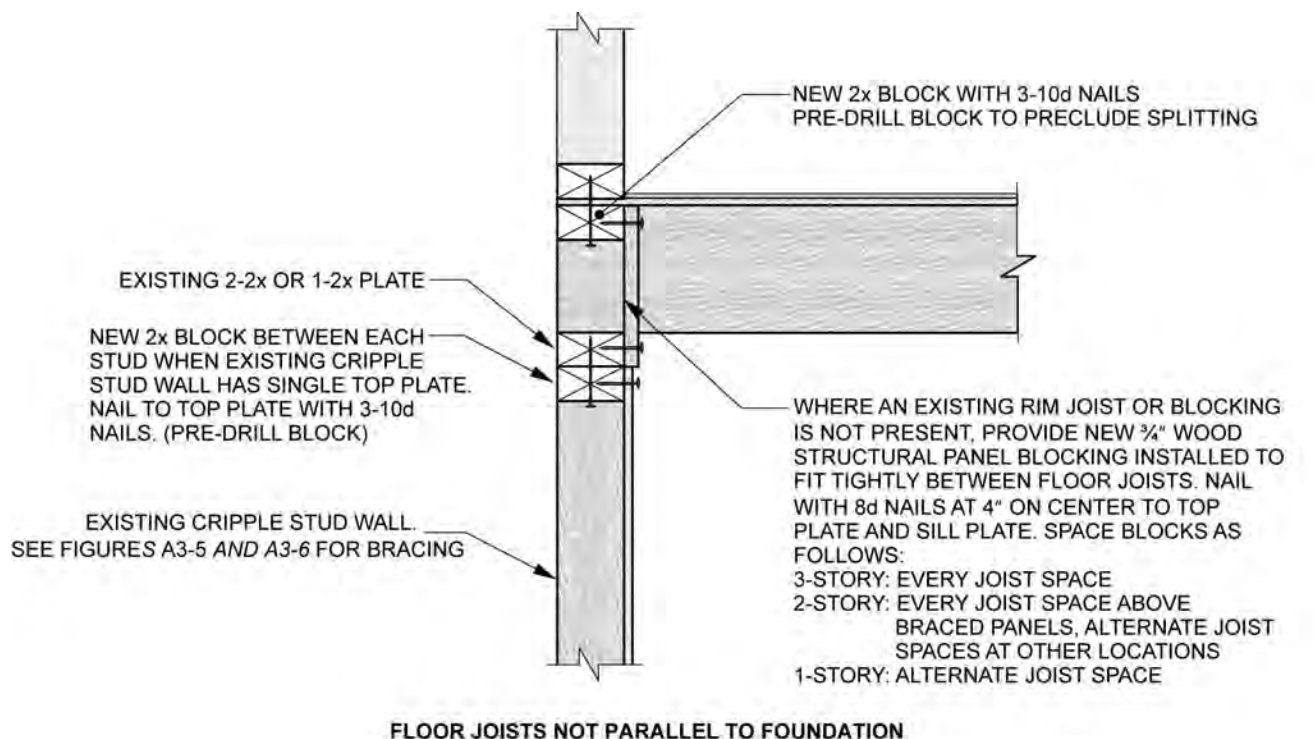
For SI: 1 inch = 25.4 mm.

**NOTES:**

1. See Section A304.3 for sill plate anchorage.
2. See manufacturing instructions for nail sizes associated with metal framing clips.

**[B] FIGURE A3-8C  
 TYPICAL FLOOR TO MUDSILL CONNECTIONS**



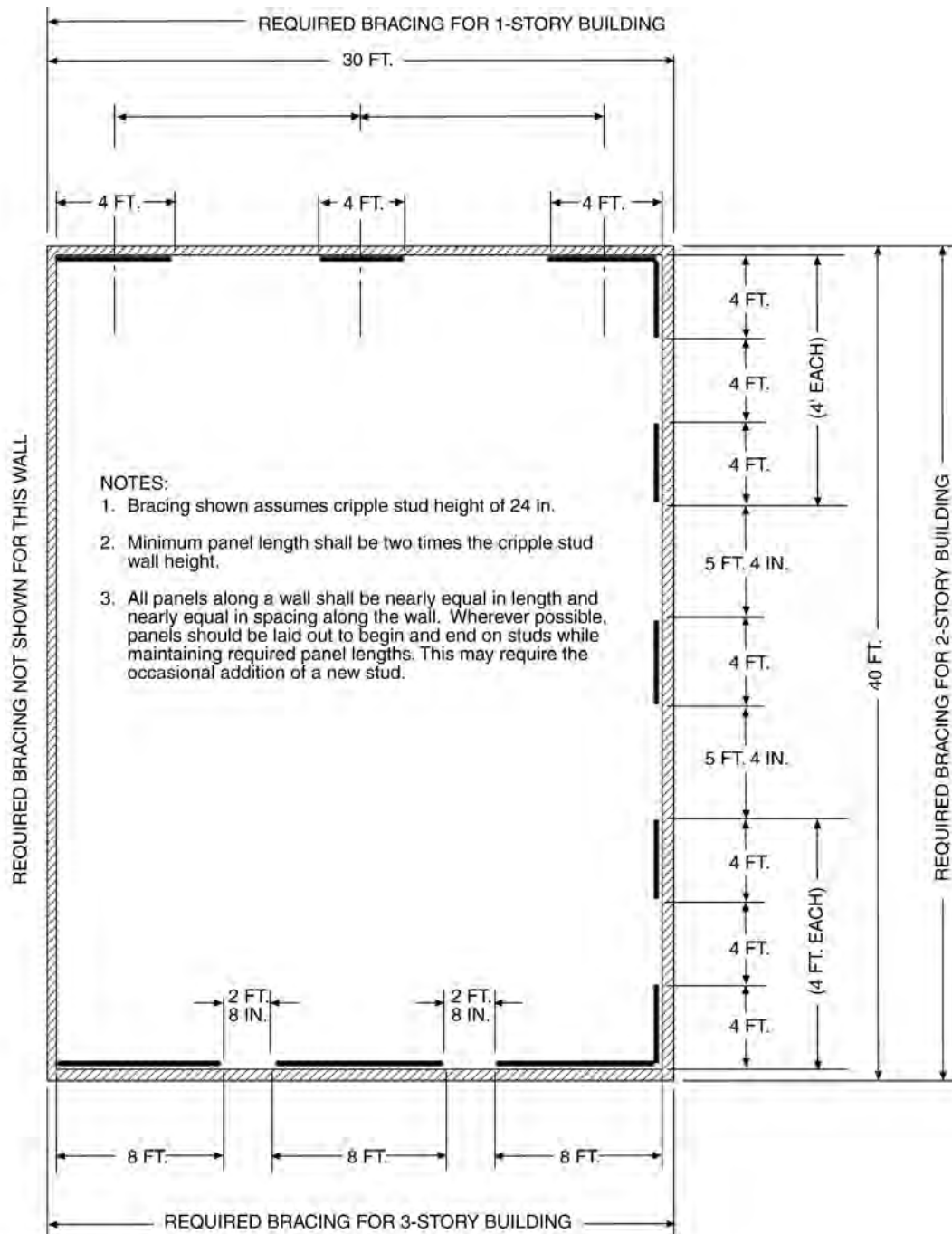


For SI: 1 inch = 25.4 mm, 1 pound = 4.4N.

**NOTE:** See Section A304.4 for cripple wall bracing.

**[B] FIGURE A3-9  
ALTERNATE FLOOR FRAMING TO CRIPPLE WALL CONNECTION**





## Bracing determination:

1-story building—each end and not less than 40% of wall length.<sup>1</sup>Transverse wall—30 ft.  $\times$  0.40 = 12 ft.

Minimum panel length = 4 ft. 0 in.

2-story building—each end and not less than 50% of wall length.<sup>1</sup>Longitudinal wall—40 ft.  $\times$  0.50 = 20 ft. 0 in. minimum of bracing.3-story building—each end and not less than 80% of wall length.<sup>1</sup>Transverse wall—30 ft.  $\times$  0.80 = 24 ft. 0 in. minimum of bracing.<sup>1</sup>See Table A3-A for buildings with both plaster walls and roofing exceeding 6 psf (287 N/m<sup>2</sup>).

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**NOTE:** See Section A304.4 for cripple wall bracing.

[B] FIGURE A3-10  
FLOOR PLAN-CRIPPLE WALL BRACING LAYOUT

# HISTORY NOTE

## CALIFORNIA EXISTING BUILDING CODE

(Title 24, Part 10, California Code of Regulations)

For prior history, see the History Note Appendix to the *California Code for Building Conservation*, 2011 Triennial Edition, effective January 1, 2011.

1. (BSC 06/12, HCD 07/12) Adoption of Appendix Chapter A1 of the 2012 *International Existing Building Code* with necessary California amendments, effective January 1, 2014.
2. (HCD 07/12) Adoption of Appendix Chapter A3 of the *International Existing Building Code* with necessary California amendments, effective January 1, 2014.



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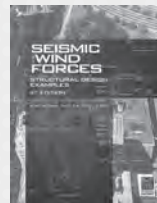


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